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Latest Improvement in Ice Machines.

IN the December number of THE MANUFACTURER AND BUILDER, in an article headed, "Making Ice by Machinery," there was given an explanation of the principle of what appears to be at present the simplest ice machine, an apparatus which probably also produces it at the cheapest rate. We refer to the machine invented by Dr. VAN DER WEYDE, of this city, which makes ice by means of steam and petroleum.

In that article such a figure was given as best explained the principle on which the apparatus works, but which did not represent the steam-engine driving the same. A similar contrivance was employed last year chiefly for experimenting purposes in New Orleans and New York, and gave entire satisfaction in regard to the economy of the principle. We have, however, now the pleasure of placing before our readers two engravings representing the actual appearance of the ice machine and steam-engine combined, as they are manufactured at present in Paterson, New Jersey.

Fig. 2 represents a front view of the upper part of the engine, and a section of the refrigerator; Fig. 1, a side view of the refrigerator and of the pump-cylinders, with a section of the cooling coil. The fly-wheel at the top, seen on edge in Fig. 2, and from the side in Fig. 1, is simply to equalize the motion of the steam pistons, to carry the cranks over their centres, and to work the eccentrics working the sliding valves. This fly-wheel is driven by connecting-rods seen at both sides in Fig. 2, while next to them are the two steam cylinders; Fig. 1 shows a short portion of the pipe conducting the steam into the steam chest. Under every steam cylinder is an air-pump, the piston of which is connected with the piston-rod of the steam pistons, so that there is direct action. The machine is consequently not submitted to the disadvantage of converting the to-and-fro motion of the steam piston by means of cranks into rotary motion, and this by pulleys, belts, and other cranks again into the to-and-fro motion of the air-pumps. One of these air-pumps is seen in Fig. 1; its cylinder is entirely under water; from its lower part proceeds a tube connecting it with the cooling coil, also immersed in water, and seen in section in Fig. 1. From this cooling coil the condensed vapor enters a central strong cast-iron reservoir, as seen at the lowest part of Fig. 1. This reservoir is at the same time the base of the cast-iron column, which supports and connects the steam cylinders above and air-pumps below. From each pump a tube goes to the freezer; one tube is seen in Fig. 1; both of them appear at the sides in Fig. 2. They are connected with the upper portion of the freezer, and serve to conduct the vapor from the same to the pumps, which in their upper portion produce suction, and in their lower compression. From the reservoir at the bottom of Fig. 1 a tube is seen to proceed, which conducts the liquid into the top of the vertical portion of the vacuum-tube (seen at the left hand of Fig. 2) through a coil, so as to cool it before it re-enters the freezer. A similar tube from the top of the reservoir conducts the mixture of gas and air which is present over the liquid in the reservoir, into the bottom of the freezer, after also passing through a coil in the vacuum tube, as seen in section at the right hand of Fig. 2, and in Fig. 1 as it appears from the outside.

The purpose of this arrangement is simply to stir the evaporating liquid, which, however, also may be done by means of rotating paddles, which accelerates the evaporation considerably.

Two thirds of the contents of the freezer seen in section in Fig. 2, and in outside profile in Fig. 1, are filled with cryogene, and contain sixty copper freezing-vessels, open at the top, and closed below. They are two feet high, one foot wide, and two inches thick, and thus may contain one third of a cubic foot, or twenty-one pounds of water each. The water, however, is not contained in these vessels themselves, but in loose and easily fitting ones, similar to the first, which contain from sixteen to seventeen pounds of water each, while the space between the two is filled with glycerine, This liquid secures contact, and is at the same time non-congealable, at least not at less than sixty degrees below the freezing point; but such a low temperature is not desired, and avoided because the ice would become too dry, hard, and brittle. These vessels are cooled by the evaporation of the cryogene in the freezer, which evaporation is produced by the air-pump, and the water in them freezes in about an hour. One of the sixty is therefore emptied from ice, and filled with water every minute, and sixty times sixteen or seventeen, or about one thousand pounds of ice are removed per hour. This rate gives us twenty-four thousand pounds per twenty-four hours, or over ten tons. For this reason a machine of the dimensions here given is called a ten-ton machine. Its cost is ten thousand dollars.

In regard to compactness and beautiful appearance this machine is unparalleled, and compares favorably with any other. Concerning the exaggerated statement in regard to some machines now in the market, which are said to produce a very large amount of ice to the amount of power employed, and which are even stated to produce ice rapidly when turned by hand, we will only remark, that generally a great difference is found between prior statements and facts proved by actual work. As yet no ice machine has been in daily operation in

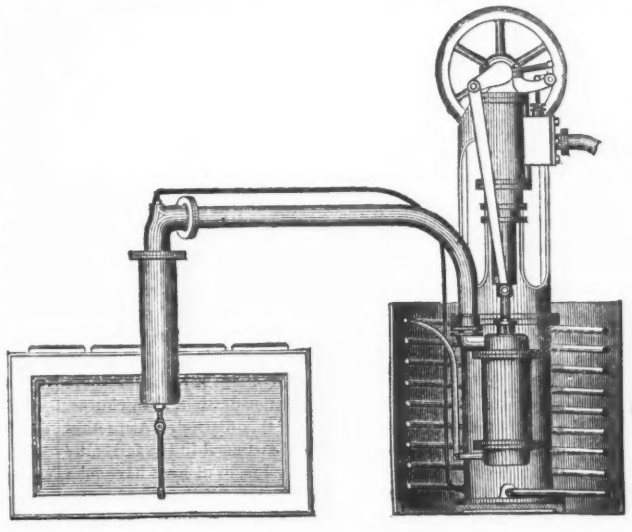

Fig. 1.

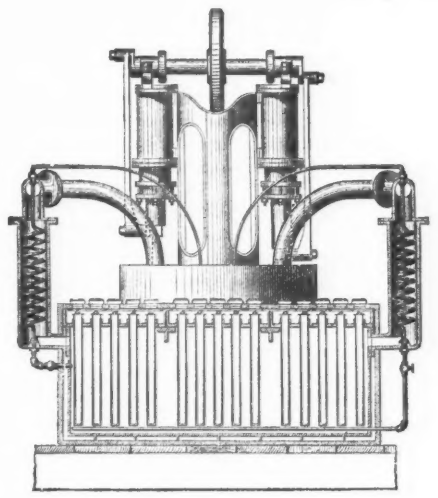

Fig. 2.

the city of New York, except the one above described, and a refrigerating railroad car working on the same principle. It is true, other inventors have occasionally given an exhibition, and produced a few lumps of ice; but as it could be accomplished at great expense only, no permanent institution resulted therefrom. The machines above described can be obtained at the office of the Arctic Ice Machine Company, No. 85 Liberty street, New York.

Lead in the Croton Water.

THE attention of the Metropolitan Board of Health having been called to the frequent cases of chronic lead poisoning which occur in the city, the chemist to the Board, C. F. CHANDLER, was directed to investigate both the Croton water and the various hair tonics, washes, etc., with a view to discovering the probable cause.

Accordingly examinations were made of Croton water which had been in contact with lead for different lengths of time, under usually occurring circumstances, of which the following are the results:

1. A gallon of Croton water from a lead-lined cistern, in which it had stood several weeks, was found to contain 0·60 grain of metallic lead.

2. A gallon of water which had remained six hours in the lead pipes of the chemist's residence yielded 0.11 grain metallic lead, a considerable portion of which was visible to the eye, in the form of minute white spangles of the hydrated oxycarbonate ($PbO,HO+PbO,CO_2$).

3. Water drawn from one of the hydrants of the School of Mines laboratory, in the middle of the day, when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe.

These results indicate the source of many hitherto unaccountable cases of lead poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures, for protection against this insidious cause of disease. Many have already introduced, as a substitute for lead pipe, the "tin-lined" or "lead-encased block tin" pipe.

Certainly no pains should be spared to impress upon servants the importance of allowing the water to run for a few minutes before taking it for drinking or cooking purposes, especially early in the morning, after the water has stood all night in the pipes. The habit of filling the tea kettle from the boiler, or of using water from the boiler for any purpose except washing, is very dangerous.

Experiment No. 2 explains a case which recently occurred in New York. An elderly gentleman was completely prostrated with paralysis or palsy. His physician at once suspected lead poisoning from his symptoms, and instituted inquiries which developed the fact that the patient had been using wheaten grits for dyspepsia, and that the first duty of the cook in the morning had been to soak them, preparatory to boiling them. She had therefore used daily the water which had stood all night in the pipes. The occurrence of a considerable portion of the lead in experiment No. 2, in suspension, instead of solution, is an additional argument for the use of filters, though it will of course be useless to employ them unless they are frequently reversed, that they may be cleaned.—*American. Supplement of Chemical News.*

Notes on the Geological Structure and Working of the Deposits of the Marquette District.

BY MAJOR T. B. BROOKS.

1. THE best method of extracting a deposit of ore will necessarily vary with the nature of the ore, its geological structure and topographical position. No one, we think, can doubt the policy of having begun work at many of the openings of our iron mines by quarrying, which may be defined as mining in open excavations.

Having a large mass of pure ore before us, of unknown form and size, and covered by but a small amount of earth (and perhaps backed by a small amount of money in the company's treasury), it would certainly be folly to incur the delay and cost incident to sinking and drifting, to open ground thus already opened by nature, and ready for us to win.

To open and equip a mine properly for the profitable production of say twenty thousand tons of ore per year will cost in this district not less than $50,000 for the dead work of sinking and drifting, and the necessary machinery to dry the mine and hoist the ore, and not less than one year's time; while in many instances the same deposit could be opened as a quarry for one-fifth the above amount, and give a large yield of ore the first year, as has been the case in the Lake Superior region where our mines are on the height of land, and the rain fall is light. Nor do our mines make much water in going down. It not unfrequently happens that the bottoms of deep copper mines are quite dry. So far as our experience in going down in iron mines extends, the same fact is likely to hold; of course, the topographical position of some mines (the Cleveland, for example) makes them marked exceptions. Second, as to the disadvantage of disturbing the surface by cuts and waste piles, this might be objectionable on a farm, but in iron mining is far more than offset by the knowledge we gain of what is below, being thereby so much the better fitted to plan subsequent work. Our ore deposits are, as it is the design of this paper to prove, *strata beds, instead of veins;* hence their extension, like coal beds, is laterally, and not vertically; hence stripping or uncovering, when it is not too heavy and expensive, is the true method of working.

2. On the other hand, however, when we have become acquainted with the general structure of the ore deposits of a particular locality, and when the earth or rock covering becomes heavy, and treacherous hanging walls will soon loom threateningly over our heads, should we attempt to work the deposit as an open cut, we may as well pause, and ask whether the centuries of experience had by miners in other districts

and other countries, under circumstances similar, and, perhaps, sometimes more difficult than ours, may not have pointed out some more practicable, permanent and economical method of extracting ores than the very obvious and simple one of quarrying, which can at best, in most instances, serve us for but a limited time, and will, perhaps, if carried too far, at the end leave our mine in a shape that will render it very difficult, if not impossible, for us to get out the remainder of our ore at a profit.

Which one if any of the well-tried systems of mining that have been wrought out and perfected elsewhere, can be advantageously applied to Lake Superior iron mining, is a pregnant question at this period in the history of our iron industry, and one that should soon be answered at all our mines. Staving off the question, under the delusion that we can quarry ore indefinitely in open cuts, will only bring future if not present loss to mine shareholders, and will likely result in a partial suspension of the economical production of ore.

3. In the time that is coming those mines which have been opened, and are now being worked as quarries, will soon have to make many changes in their system of working, their traditions, organization and labor. The common laborer with his pick and shovel, horse and cart, barrow and derrick, will play a far less important part. In their place will be found the skilled miner, steam engines, nitro-glycerine (perhaps), and the tallow dip. Mining engineers, mining captains, and timbermen will be found in the staff of the mine. Then our mines will continue in a long career of prosperity which may be interrupted by irregular or unwise tariff legislation, but which can only be terminated by the exhaustion of the beds, which must sooner or later come. The critical period for each mine is the transition from the old to the new system; to stop quarrying, and begin mining in time to make no interruption in the supply of ore. It would be a very serious drawback for any mine to be able to supply only one-half its regular customers for a season or two, especially if there happened to be active competition. This danger is plainly pointed to by the disaster last fall at the New England slate ore opening. The hanging wall of talcose schist fell in, destroying a large amount of timber work, and completely stopping mine work for a long time. A large expenditure of time and money will be required before the mine can be again made productive. This danger is increased by the fact that reserves of ore from which to draw during times of low product, are unknown in the district. We "pick out the eyes of our mines," to use a Cornish expression, at the close of every shipping season. This is perhaps the best policy in this country, for the miner never knows but that the next Congress may destroy his business. Hence, like Paddy in the free fight, who hit every head he saw, wherever we see ore we mine and ship it, getting it into money, the value of which legislators cannot so easily affect.

4. Probably the most important preliminary question connected with the adoption and putting in practice of a permanent regular system of mining, and the construction of the necessary works which are to affect the whole future of the mine, and determine to a great extent the amount of its profits, is that of the *geological structure of the ore deposits themselves.* Certainly to extract a mass of hidden ore advantageously, the more we know of its position, form, side direction and dip, and the better our acquaintance with the nature of the associated rocks, particularly of the hanging wall, the better we can plan and execute our attack on such ore mass—the better we can locate our permanent machinery and shafts, our tunnels, pockets, dumps, tracks and roads, waste and stock piles, and place the necessary houses. I do not believe there is a mine in the district that does not present one or more mistakes due to a want of knowledge as to where the ore lies in the ground, its quality and quantity. Some of these mistakes have been serious and well nigh disastrous. If the hanging wall be firm, and the deposit of such thickness that it can be easily timbered, and it be regular in its dip for a considerable depth, the case is comparatively simple, and may be treated as most of the Lake Superior copper veins are, and as has been done to some extent in the iron mines of New York and New Jersey. If, on the other hand, as is often the case here, the bed be of a thickness beyond the limits of ordinary timbering, say thirty feet, and particularly if the hanging wall be the soft, treacherous slate, so often found in our mines, and the bed vary in thickness and dip, as is almost universal, then we have presented one of the most difficult questions in practical mining. I may here properly quote a portion of a letter from WARRINGTON W. SMYTHE, crown inspector of mines in Great Britain. I sent him a rough sketch, giving an approximate section of the Lake Superior mine similar to the one presented, and asked him to name some book which treated of a similar case. He very kindly replied in a private letter, from which I venture to make the following extract:

"We have no English books which deal with the problem you have set before me; nor have we, indeed, any case analogous to that of the very remarkable ore bed which you describe. The only work which we have in Europe dealing pretty fully with the working of deposits of various thickness and position, is that of M. PONSON, of Belgium, on 'Good Mining,' published at Liege, in three octavo volumes, with a folio of plates. In this you would see how the Belgium coals get into position alternately flat and highly inclined, and have to be worked in the two cases, by different methods. But then these seams are thin, and offer smaller difficulties. Your district will have, I suspect, to follow out the plan which the French are doing very largely in some of their coal mines, where the beds are from thirty to ninety feet thick, but broken and turned up usually at high angles. This is the mode of working, as they call it, by *remblais*, or filling up as they go on, with loose stuff—clay, coal-measure, shale, grits, etc.—taken down for the purpose, often through special shafts and drifts, so as not to interfere with those devoted to coal raising."

5. If the above general view of the question be correct, then it is evident that all sources of information as to the details of geological structure should be exhausted before a plan is made and underground work begun; and then, on the uncertainties which are inherent to the question, our system should be so devised as to have sufficient elasticity, so to speak, to meet probable unknown conditions which the progress of mining may develop. Fortunately, the vast excavations now open to daylight at our several mines present a fine opportunity to study the general structure. The details are in many cases obscure, the quarrying process having removed and deposited in stock or waste piles material, which showed many curious geological phenomena, and which could have been studied to advantage. In the New Jersey and New York magnetic districts, the deposits being in most particulars similar to our own, much light may be had, and still more in the Swedish iron mines, which have now been wrought several centuries, are very extensive, and which afford fine examples of the geological structure of the metamorphic azoic ores, to which class ours belong. From these sources of information, giving first place of course to the facts gathered in our own mines, we should be able to make out the structure of our own deposits—if not in detail and absolutely sure, at least such a general hypothesis as will be of much value in planning for future work.

6. The first, and by far the most important, inquiry in this study of geological structure, and the one to which the remainder of this paper will principally relate, is this: Do our Marquette iron ores occur in *beds* or *veins;* that is, are they highly metamorphosed and disturbed aqueous deposits, which were laid down at the same time as the associated rocks, or have they been since formed, in which case they must be either volcanic dykes, or else fissures or segregated veins.

This question is not presented as a purely scientific one, because I conceive such questions are not within the scope of this Association's objects, and because, as a theoretical question among geologists, it has been settled. But it is presented as a practical one, bearing directly on the economic extraction of iron ores, and as a question on which those engaged in the direction, management and working of our mines, widely differ. If our deposits or any of them are true veins, then the regular system of vein mining, which is finely exemplified in the Lake Superior copper district, covers the case, except that in some instances our deposits, being of unusual thickness, may require some modifications in the system. If, on the other hand, our ores constitute strata beds, conformable with the rocks with which they are associated, then we have a structure entirely different, and requiring a different mode of procedure, and in this case should look for our models to the very thick coal beds of France, or perhaps better, to those of Belgium, as being more contorted, folded and disturbed; hence more closely resembling, in their irregularities of dip and thickness, the highly metamorphosed schists of this district. At present several of our mines are directed and managed in the full belief that the ore deposits are either true veins, or at least have such essential qualities of veins that they may safely and advantageously be wrought as such. In some instances the mine superintendents, our worthy Vice President included, are full believers in the bedding theory of formation. Probably in most cases there is no settled belief on the subject, nor much faith in the advantage of such knowledge; but in place of any such doubt, a feeling of certainty to the effect that geologists are dangerous dreamers, and that the Lake Superior iron mines present inexplicable phenomena, such as was never before seen in the earth, and such as geology will never explain nor find duplicated elsewhere. Lake Superior iron ores being almost exceptionable in richness, so they would naturally be in structure.

7. In the hope of presenting a full logical proof on this question, to the few who are in doubt, I shall, even at the risk of being tedious, cite those definitions and characteristics of veins which are taught and accepted by the best authorities, together with the characteristic phenomena of our ore beds, thereby hoping to prove that they cannot be rated as veins or igneous deposits, but on the contrary, are true aqueous beds, or rock-layers.

(A.) A true vein is a fissure or crack in the solid crust of the earth, of indefinite length and depth, filled with some metallic ore or mineral substance, different from the containing rock. Veins, in most instances, extend across the lines of stratification of the formation in which they lie. In the rare instances in which they conform with the bedding, such coincidence is not for any considerable distance.

Now, if we look among the beds of magnetic and specular hematite ores of Lake Superior, Missouri, New York, New Jersey, and, I feel safe in adding, Sweden, we shall find them conforming exactly with the stratification of the containing rock, and in no instance crossing it as veins almost invariably do. [It should be here remarked that owing to the great metamorphic and dynamic action to which the formations under consideration have been subjected, the bedding is often obscure and sometimes entirely hidden.]

(B.) Veins are usually in groups, parallel in course, or strike and dip. Beds of iron ore, if several in number and regularly folded, present a similar phenomenon on the surface, as is seen at the Mount Hope mines, and others in New Jersey. It is safe, however, to say that the Lake Superior ores never present this appearance. The fact that there is a general east and west parallelism, is not to the point, for at the Jackson, Cleveland, Lake Superior, and Washington mines, there are dips in the same bed to every point of the compass, and from vertical to horizontal, within a very small area.

(C.) Veins very seldom underlie at a less angle than forty-five degrees with the horizon, and, as a rule, are much nearer the vertical. Their prevailing direction is downward, toward the centre of the earth. On the other hand, our iron ores are often horizontal, and seldom vertical. The many folded beds, which are plain to be seen at the Lake Superior and Jackson mines, and undoubtedly exist at the other mines, must contain parts that are horizontal at the bottom and top of each alternating fold.

(D.) Veins generally run straight, both on the surface in their out-crop and downward; that is, their boundaries are more or less regular inclined planes. If the vein changes its course from a fault or throw, it will usually be found at no great distance, taking its first direction. This is as far removed as possible from the facts in the case of our iron ores. This comparison might be continued to the exhaustion of all vein phenomena, with results as above. We might point out that the mineral constituents of veins — quartz, calcspar, fluorspar, heavy-spar, and other minerals—not only are not characteristic of our iron ore beds, but, except the first, are wanting. Instead, we find in our iron mines large beds of talcose and chloritic schists which are found in veins. Quartz is found universally associated with our iron ores, as it is in veins, but not having the same form. In the specular hematite mines, it is in thin beds, interlaminated with corresponding thin beds of rich ore, or is in fragments, forming a conglomerate. In the lower horizons, or flag-ores, the quartz is so intimately mixed with the oxide of iron as to produce a homogeneous lean ore. Again, the gossan, or decomposed vein matter, which almost universally caps true veins, finds no counterpart in our mines. On the contrary, no perceptible change in richness or in the mechanical condition of the ore, has been observed between the surface and lowest point yet reached in the district, say two hundred feet. Experienced vein miners, of which there is at least one present, will not consider this comparison complete, if I do not refer to the change in the character of the mineral contents of true veins, due to the passage of the lode from one kind of rock to another. Certain rocks are known to produce rich bunches in the lode, while other rocks give comparatively barren ground. Nothing allied to this phenomenon has been observed in iron ores of the character we are discussing.

8. If the above be accepted as accurately describing a fissure vein, and as presenting correctly some of the characteristic geological phenomena of our deposits of iron ore, then the latter not only are not veins, but, on the contrary, are so unlike them, that it would be unsafe to apply any of the principles, practices, or terms of vein mining to our case, without a careful consideration of the subject, else much confusion, uncertainty, and perhaps loss, may ensue. This is a practical point of much importance, because many of our miners and experts, having got their experience in vein mining in other regions, are slow to modify their traditions and methods to suit the very different case presented here. It would be still easier to prove our deposits are not dykes or fissures, which are supposed to have been filled by volcanic agency. Any person in the district can satisfy himself on this point by an examination of a trap-dyke pointed out by Mr. BREITUNG, in the Washington mine. Neither can they be segregated veins, as could be proven. We have left the hypothesis with which we set out, and which completely embraces all of the facts adduced; that is, that the ores in question are simply strata beds, or rock layers, having the same general form, origin, and structure, as the layers of chloritic and talcose schist, the quartzites, and diorites, with which the ores are associated.

9. A simple view of the question is to regard the oxide of iron as one of the half-dozen minerals which were chiefly used by the Great Architect in building our Huronian formation. Put our iron ore on the same footing as quartz, chloride, talc, hornblend, feldspar, and argillite, and all difficulties of structure of the nature we have been considering, vanish. When the mineral oxide of iron alone was employed in the composition of a layer, a bed of iron ore was the result; in the same way, when quartz alone was used, we find quartzite as the result; when these minerals were mixed, the silicious ores were the result, which are, unfortunately, twenty times more abundant than the pure ores. It is safe to say that the oxide of iron, although seldom pure, exists in all our rocks in greater or less quantity. Just the same may be said of the mineral quartz. In brief, we may say that nature seems to have incidentally employed iron ore as a building material, just as she employed other, apparently to her, just as important materials. She does not seem to have changed her plans nor specifications when the iron ore course of crowning-stones were laid. Men finding such ores infinitely more valuable than the other rocks, are led to suppose that some great convulsion, some means out of nature's ordinary course, were resorted to for its production.

10. Although foreign to our district, it is not improper here to notice the vein-like structure presented by most of the New Jersey magnetic iron mines. There, it may be truly said that some of phenomena of true veins can be found, and that many of the beds are worked successfully on a system of vein-mining. This fact does not shake the aqueous theory of origin, which we are endeavoring to establish. The same folds exist there as here, only they are more regular and deeper. In this district, so far as yet made out, no fold is more than one hundred and seventy-five or two hundred feet from crown anticlinal; deeper ones will undoubtedly be found; while to the east the azoic rock waves run much higher. In Sweden, the ores have been followed down over six hundred feet on a tolerably uniform underlay. Even in the New Jersey region, the folds are not always so deep. A geological survey, made by myself, for COOPER & HEWITT, of New York, of the Mine Hill mines on the Durham estate, near the Delaware river, in Pennsylvania, which may be regarded as the extreme southwest end of the New Jersey iron region, developed a shallow synclinal basin, the axis of which pitched to the northeast. The result of this survey has since been published in Professor COOK's report on the Geology of New Jersey, page 332. My friend, EDWARD HARRISON, Esq., of Irondale, Missouri, has sent me a section of the Iron Mountain mine, Missouri, which shows it to be

grand anticlinal fold, all of which proves that the same general law of structure holds for azoic ores throughout this continent.

11. I might here enumerate numerous localities in this district presenting phenomena which can only be explained by supposing our ores to have been deposited from water, and afterward highly metamorphosed. All are familiar with the Cleveland knob, its whole surface striped with alternating red and metallic bands, which bend and double back on themselves, then reverse into an infinity of angular curves, but continuing always uniform in thickness, and parallel with each other, pointing back to the still water in which were originally laid down the thin, alternate beds of ore and quartz. Who that has observed the working of our mines has not seen a thin knife edge of slate make its appearance in the midst of good ore, which, growing larger as it followed in the direction of the bedding, may entirely crowd out the ore, and occupy the entire space between the walls of the bed, but more generally is satisfied with less thickness, and if followed will, after passing its maximum thickness, begin to thin out, and finally disappear in an opposite knife edge.

Perhaps the best place in the whole Lake Superior region at which to convince the skeptical that our ores are stratified, and are, in geological structure, precisely like the overlying and underlying rocks, is at Smith Mountain. Here nature has condensed, so to speak, the geology of the whole district in a small area.

Commencing at what is one of the youngest rocks in the Huronian system, so far as developed here, that is, the upper or conglomerate quartzite, we pass geologically down next over the specular hematite (sometimes magnetic), then the several diorites and schists alternating with ferruginous slates and flag ores to the lower quartzite which is seen reposing non-conformably on the protogine and gneiss of the Laurentian system, as first observed by Prof. R. PUMPELLY. These rocks, standing on edge, and laid bare by windfalls and fires, are as easily studied as the specimens of a cabinet.

12. Some of the conclusions, theoretical and practical, concerning the ores of the Marquette Iron District, which the facts above cited, and others well known, point towards, are these :

(1.) These ores were deposited by water at the same time and in the same manner as the underlying and overlying rocks with which they are associated.

(2.) There are several horizons of ore, the upper or youngest being the purest, and the one from which the specular hematites and magnetic ores now being shipped from the district are mined.

(3.) That the ores of the different horizons at places so closely resemble each other that the best scientific and practical judges have mistaken one for the other. That all the mining failures in the district have come from this mistake, which can only be surely avoided by a full geological understanding of the locality.

(4.) That at certain places in the different horizons, from some cause, the ores have become partially or wholly disintegrated, and so changed chemically as to produce limonite; that is, the "soft hematite" ore of the district. The Jackson hematite is a changed specular ore. The Foster hematite is from a limonitic silicious schist in one of the lower horizons. There is much uncertainty as to the quantity, in any given place, of the ores of this class.

(5.) That while the several ore formations are tolerably regular in thickness, measured from over to underlying rock, in their internal structure they present considerable variety in their mineral composition, being made up of oxide of iron, generally mixed with red quartz (so-called jasper), which is often in such quantity as to render the "mixed" ore valueless in present market. In addition to red quartz, there are frequently found lense-shaped masses, sometimes of immense size, of talcose and chloritic schists, the form of which is described above. These alternate with similar lenses of the pure and mixed ores, the whole presenting a structure not unlike that of the muscles of an animal. As if to still further complicate the question, the same lens or layer will change gradually from a first-class "shipping ore" to a worthless "mixed ore." This arrangement closely resembles what DANA calls "ebb-and-flow" structure. I would almost agree to duplicate the figure given on page 93 of his Manual of Geology, in the Cleveland mine. Sometimes these lenses of ore and rock terminate so abruptly at their edges, and are so long in the direction of one axis as to be best described as pod-shaped. A writer in the *Annales des Mines* some years since described some of the ore deposits of Sweden as "flattened cylinder" shaped masses. Such are common in New Jersey. See Prof. COOK'S Report on the Geology of that State.

(6.) That since the original deposition of the ore, which must have been in nearly horizontal layers, the beds have been subjected to great dynamic action which has wrinkled and folded, and broken, and in some instances almost capsized the whole series of associated rocks.

(7.) The extent of the ore in the Marquette District, at least so far west as the Washington mine, appears to be limited to a narrow synclinal basin, in which are several shallow folds. The exhaustion of any given length of this basin is certain to be attained if work be continued. The quantity of ore in a given length should be approximately computed by proper surveys.

(8.) These peculiarities of structure produce in the beds endless changes in dip, strike, thickness, and quality of ore, as well as in the nature of the containing walls; hence presents, or will soon present, some of the most difficult questions in practical mining. In a few fathoms I have seen a bed not only change its dip from vertical to horizontal, but, following its strike, the same bed has abruptly changed from a thickness of forty feet to as many inches. If at the same time, as might easily have been the case, the same bed had changed from pure ore to nearly pure jasper, the metamorphose would have been complete, embracing composition, form, and position. Perhaps the most perplexing thing the underground miner will have to contend with is the varying and treacherous nature of the hanging walls when composed of the schists above named, which practically will not stand unless supported throughout their whole extent.

(9.) The best general principle on which to extract our ores is undoubtedly the one which has been generally followed in the district; that is, find the ore, follow it by uncovering and quarrying as long as it will pay, then abandon the opening, and find a vein where the same process is repeated, using as little machinery and skilled labor as possible. But when this system has exhausted all the ores that will pay under it, which will speedily be done at each mine, then there will be left large amounts of ore which may be extracted by proper mining, so as to give a fair return to mine shareholders.

(10.) Just what methods will be best suited to our case and to the labor and skill available here, experience must decide. It is safe to say that a knowledge of what has been done elsewhere under similar difficulties, coupled with actual experience in this district, would afford the best chances of success. Whatever plan be adopted, time will be required for its consummation; hence preparations for underground work must be made in time, or production must cease when quarrying finds its limit.

(11.) It is not likely that narrow beds can ever be followed so far or under such difficulties in this district as in the magnetic regions of New York and New Jersey, because ore on the mine bank is worth nearly twice as much there as here. I suppose that two-thirds of the mines now wrought at a profit would have to be abandoned if here, as will appear from the following approximate comparison. The worked beds in the Marquette District average not less than two and one-half times as thick as those in Passaic, Morris and Sussex counties, New Jersey, and the ores produced contain at least 10.70 more metallic iron; and they lift their ore and pump their water at least five, and probably ten, times as high as is necessary at our mines. A sixty-five per cent. ore is worth on our mine banks from three to four dollars, while in New Jersey a fifty-five per cent. ore is worth five to six dollars at the mine.

(12.) It is not too much to expect of geological science, that if it be given the benefit of careful records of deep borings made in and about our mines, in addition to what can be seen here and elsewhere, that it will in return be able to furnish the mine superintendent with such plans and sections, with predictions as to position and quantity of unseen ore masses, as will greatly aid him in the uncertain and expensive work of opening his mine by means of shafts and drifts, as well as in the location and erection of the necessary pumping and hoisting machinery.

The Iron Mines of Pilot Knob, Missouri.

By DR. F. STAPFF, St. Louis, Mo.

THOUGH winter is no pleasant season for geological excursions, both in the old and the new country, the mock-winter which rules Missouri has not prevented me from spending several days during last December in the survey of Pilot Knob and neighboring ore mountains. There was no snow on the dry and slightly-frozen ground, and the sun, shining from a cloudless sky, invited graciously to walks across the brushy mountains of the "Puke State." In the following lines I present an abridged account of observations made during those walks.

Having recently seen the description of Pilot Knob by Messrs. SWALLOW and LITTON, in the Report of the Geological Survey of Missouri, I find essential differences between our respective modes of intuition, and I would have attempted to make my communications more conformable with those of the State Geologists, if the latter were not founded on observations made sixteen or seventeen years ago, when the ore beds of Pilot Knob were not so much stripped and worked as they are to-day. For this reason I venture to go my own way, being guided, however, to some extent by striking analogies between the nature of Missouri and Swedish iron ore beds. At the same time, I regret very much that neither SHEPHARD'S "Description of Iron Mountain, Pilot Knob, and the Surrounding Country," published in the *Western Journal and Civilian*, (Vol. VIII., page 140), nor FOSTER'S and WHITNEY'S "Report on the Geology of the Lake Superior Land District," (Washington, 1851, part II.), could be consulted, as these papers are said (Report of the Geological Survey of Missouri) to contain much useful information on the subject. Some topographical figures and analyses are, however, borrowed from the Report of the Geological Survey of Missouri.

Pilot Knob is situated at the present terminus of the Missouri Iron Mountain Railroad, in Iron county, between the small towns of Pilot Knob (north) and Arcadia (south), eighty-six and a half miles west-southwest of St. Louis. Its distance in a southwestern direction from the Mississippi river, along the plank-road from St. Genevieve to Iron Mountain, is about fifty miles. The mountain is a link in the range of hills which, with an east-northeast bearing, stretches through southern Missouri from Springfield to the Mississippi valley, south of St. Genevieve. This range, forming the water-shed between rivers running northward to the Missouri, Merrimac, and Mississippi, and others running southward to the Arkansas and Mississippi rivers, is chiefly constructed of felsitic rocks, which underlie nearly horizontal silurian strata. Northward these strata are successively covered by newer ones, belonging to the Devonian and sub-carboniferous periods, and finally the Missouri coal measures are met with on both sides of the Missouri river.

Pilot Knob rises almost isolated from the level bottom of the broad Stout Creek valley, which, together with its forks and branches, environs the northern, western, and southern slopes of the mountain. Eastward it is connected by a broad and low saddle with a ridge, which is gradually getting higher on its course to the east. The western summit of this ridge is called "Little Pilot Knob."

The highest point of Pilot Knob is situated five hundred and eighty-one feet above the plain, which (between the depot, hotel block, and the company's store,) is elevated five hundred and thirty-seven feet above the curb on Front street, St. Louis. The base of the mountain being circular, and possessing an area of three hundred and sixty acres, (a map of 1858, drawn by W. H. COSENZ, says five hundred and sixty acres), has a diameter of about four thousand four hundred feet. Pilot Knob has a very regular and symmetrical shape, if we abstract from the craggy formations on its top and from the excavations and piles of *debris* which are a consequence of the last twenty years' mining on its northern and northwestern slopes.

Seen from Shepherd's mountain (southwest), Pilot Knob presents a bluff bank around its foot, a gently-sloping platform around its middle, and a steep, conical top, which is crowned by a confused mass of rough cliffs. All sides of the mountain show the same configuration, but generally the eastern slopes are steeper than the western ones, for the composing stratified rocks dip in conformance with the latter, and have their outcrops on the former. Some plates represent Pilot Knob when seen from the north (or in a direction almost at right angles to that mentioned above), as a quite regular cone, with slopes of some thirty or forty degrees. In reality, the average slope of the mountain is ten to eleven degrees at the foot, six to seven degrees in the middle, and fourteen to fifteen degrees near the top. The cliffs on the summit present themselves in the most manifold groups, varying with the spectator's point of view, and sometimes reminding him of ruined gigantic structures.

The open position of Pilot Knob, its peculiar shape and prominent crown of cliffs, have made this mountain a mark for travellers, trappers, and hunters, who were the pioneers of the country, and hence the name. Formerly, a dense growth of timber covered its flanks, but nothing is left of it now but brushwood and some isolated oak and hickory trees, which have escaped the wood cutter's axe.

The rock prevailing on Pilot Knob is a dense crypto-crystalline felspar, (felsite, eurite,) quite the same thing which, under the name of "hälleflinta," encloses a great number of the very best Swedish iron ore beds. This rock appears as *porphyry*, chiefly on the north-eastern side of the mountain (footwall of ore bed), as *porphyry conglomerate* and *breccia* on its south-western side (hanging wall of ore bed). It is distinctly stratified above the ore bed, indistinctly below it; bears north sixty-seven degrees west, and dips twenty to thirty-seven degrees, on an average thirty-three degrees southwest. Near the summit many thin layers of specular iron ore partake in the stratification of these porphyritic rocks, which further down inclose the true ore bed. This is a concordant link of the surrounding stratified rocks, having the same bearing and dip as the latter. It consists of *specular iron ore*, stratified by the intercalation of thin layers of slaty rocks and conglomerates—all bearing northwest and dipping southwest.

At the north-eastern foot of Pilot Knob almost horizontal strata of *magnesian limestone* may be observed, forming the northern descent of the saddle, by which Pilot Knob and Little Pilot Knob are connected. The limestone is covered by nearly horizontal strata of *sandstone*, at least on the western flank of the saddle. At its eastern flank this sandstone is wanting at the foot of Little Pilot Knob the limestone being directly covered by *clay* and *detritus*. These quarternary formations cover the larger part of the solid rocks which compose Pilot Knob.

The general geological features here exposed are demonstrated by the following:

The magnesian limestone is based on the north-western foot of Little Pilot Knob, where it is quarried as a flux for the smelting processes; it is also stripped in some ravines and holes between the two knobs and on the north-eastern foot of Pilot Knob, and is arranged in thick layers, bearing north five degrees east, and dipping six degrees southeast; but its total thickness cannot be observed at this spot, as only about thirty feet of it are laid open. The magnesian limestone is of a grayish white color, crystalline and full of numerous vuggs, which are lined with small rhombohedral crystals of brown-spar and isolated crystals of calc-spar. Commonly the brown-spar crystals are veiled by thin yellow skins of hydrated peroxide of iron, whilst the flat rhombohedral crystals of calcspar are transparent and clear as water. According to an analysis of Dr. LITTON, (Report of the Geological Survey of Missouri) this limestone is composed of: SiO_3 5,62; Al_2O_3 and Fe_2O_3 0,82; CaO CO_2 50,10; Mg.O CO_2 43,24. All fissures and seams between the different layers are filled with a loose greenish hydrated silicate of alumina, protoxide of iron and, probably, alkali, the color of which turns to brown when partially decomposed. The uppermost layers of limestone, stripped in the quarry, are highly waterworn, and covered with about twenty feet of stiff clay of red and brownish colors. This clay seems to be the last product of decomposition of the same porphyry, more or less waterworn and decomposed boulders of which are imbedded in the clay.

At the north-eastern foot of Pilot Knob a thin stratum of lime conglomerate is deposited above the limestone and below the next following strata. The sandstone, which bears north sixty-five degrees west, and dips six degrees north-east, has a total thickness of twenty to thirty feet, and is parted in rather thin rough layers. The whitish gray sandstone is highly mixed with the green mineral mentioned above, which fills fissures and cavities in it. The sandstone used for lining the furnace hearth at Pilot Knob is not quarried in the strata just mentioned.

Higher up the mountain a second deposit of lime-conglomerate is met with, composed of grains of quartz, felspar and por-

phyry, which are cemented by lime. But the line of contact between sandstone and this conglomerate is not accessible for observation, nor are the younger strata visible, which possibly exist above the conglomerate, a thick cover of clay and stones, rolled from the summit, hiding all solid rocks and layers up to the footwall of the ore bed, where porphyritic rocks appear.

No petrifactions have been observed in the layers of magnesian limestone and sandstone mentioned. Nevertheless the geologist must arrive at the opinion that these strata, independent of the architecture of the felsitic rocks in the interior of the mountain, belong to the calciferous epoch of the lower silurian period.

The felsitic or porphyritic rocks forming the bottom of the ore bed are accessible for observation on the northern slope of Pilot Knob, along the northern and north-eastern border of the large ore quarry, and in some diggings recently made south-east of this quarry. Near the foot of the mountain these rocks show the dense, crypto-crystalline, felsitic, chief constituent part of common felspar porphyries, but crystalline grains of felspar and quartz, the second ingredient of porphyries, are here rather thinly interspersed. The rocks have a grayish, reddish or brown color, and often show streaks and flamy spots. Many irregular fissures, running in all directions, render it highly difficult to distinguish the indistinct stratification, by which the rocks are divided into thick layers having a north-west bearing and a southwest dip. Walking up the tramway from the furnace to the ore quarry, one meets, above the gently sloping middle zone of the mountain, plenty of rubble-stones, which *partially* seem to be the crushed outcrops of rocks *in situ* near by. Among these rubble-stones one observes the species of rock just described, veritable white-spotted porphyries, partially decomposed porphyry of light flesh-red color, with white and green flamy spots, and conglomerates and breccias, in which grains of quartz, felspar and red ferruginous silex are cemented by the chief ingredient of porphyry. Many of these stones contain more or less specular iron ore, which appears sometimes as micaceous iron in isolated small leaves, sometimes as a pigment, coloring certain thin layers of the stratified species of rock. Besides these, one finds specimens of ore and of slate impregnated with ore, which evidently originate from the ore bed above. Close to and northwest of the quarry the tramway is cut through the northwest side wall of the ore bed. The rock struck here is porphyry and porphyry-conglomerate, both containing isolated leaves of micaceous iron ore. Crystalline grains of felspar, interspersed through the chief porphyritic ingredient, having been subjected to a partial decomposition, give to the porphyry a white-spotted, variolitic exterior. Numerous fissures through these rocks are filled with white or greenish loose minerals, evidently products of decomposition of the surrounding felsitic rocks. The most prevailing of these fissures, bearing north fifteen degrees east and dipping eighty to ninety degrees south-east, designate in some degree the northwest boundary of the ore quarry. The same rocks as here described, namely, red and brown porphyry matter and conglomerate, are also stripped and exposed to view on the eastern slope of Pilot Knob, where some diggings have been begun for striking the ore bed from the foot-wall. The ore bed is struck from the side, by the cut mentioned, four hundred and forty feet above the base of the mountain; it dips below this level towards the west and rises above it to the east. In the last named direction it has been quarried up to the foot-wall, which in the first named is not yet reached. The foot-wall, where stripped, is very well distinguished by a plain, black, heavy slate, which makes a light red powder, and seems to be composed of slaty felsitic matter, highly impregnated with the peroxide of iron. Between its upper strata intercalations of thin strata of pure iron ore appear in places. These, increasing more and more, mediate a transition to the ore bed proper. At other places thick and pure layers of iron ore follow immediately upon the foot-slate, which then has a thickness of only a few inches. The bearing of this very distinct selvedge being north sixty-seven degrees west, in the eastern wing of the quarry, with a south-western dip of thirty-three degrees on an average, seems to turn westward (and the dip southward) in the middle and on the northern border of the quarry, so as to indicate a slight curvature of the ore bed, with a convexity to the northeast. This circumstance will prove of high practical influence upon the prospecting, testing and mining of the ore bed at lower levels.

The slaty foot-wall is not stripped around the northern and north-eastern mountain flank, an edge of rock being left there, between it and the quarry. It is remarkable that this edge, which is situated in the line of the ore bed, is composed of porphyritic rocks and not of ore; of course it indicates the north-western lateral wall of the ore bed. The rocks in this side-wall are thoroughly impregnated with fine particles of iron ore, which make them black and heavy. But their low percentage of iron forbids the profitable mining of these rocks. Further away from the ore bed, the contents of iron and the black color of these rocks disappear very soon, so that one might suppose the existence of some fault along the ore bed. The rocks below the slaty foot-wall are also black and heavy by impregnations of iron ore, at least at one point where these rocks were stripped. The south-eastern wall of the quarry, almost entirely composed of iron ore, offers a plain sectional view of the Pilot Knob ore bed. Nevertheless it is difficult to state the exact thickness of the ore bed, its upper strata being ruined and partially denuded on the eastern side of the quarry, where the foot-wall is exposed, and its lower strata not yet touched on the western part, above which the hanging wall of the ore bed is accessible for examination. Besides, the boundary line between ore bed and hanging wall is not clearly demarked, because it runs through the foot of the overthrown cliffs of the summit, and because the hanging wall is highly impregnated with ore. As a mean of different observations and calculations, I rate the vertical height of the ore bed to be about sixty, and its normal thickness about fifty feet.

The ore is a pure specular peroxide of iron, possessing a fine crystalline, often almost close granular fracture. Subtile lamels of micaceous iron, thin strings of quartz grains and spots of kaoline (and serpentine?) may often be observed in the strata of compact ore. The composition is, according to

	Dr. DORNBACH.	Dr. LITTON (Rep. Geol. Sur. Mo.)			
Iron	54,307	86,07	60,25	73,74	51,62
Oxygen	26,720				
Silicon	—	12,03		23,12	
Aluminum	—	1,61		2,78	
Matter not dissolv'd in acid	17,509	—		—	
Total	98,536	99,71		99,64	

It is to be regretted that these analyses explain nothing about the existence and quantity of those matters which have the greatest influence on the quality and value of iron ores, namely: phosphorus, sulphur, and manganese.

The ore is deposited in parallel layers, varying in thickness from scarcely an inch to several feet, all bearing north-west and dipping southwest, conformable with the footwall. Between the ore strata very often thin seams of porphyry-conglomerate, and thicker strata of a dark slate, impregnated with iron ore, are intercalated. Very illustrative for hypotheses concerning the origin of the ore bed are also alternating strata of ore and felsitic matter, both not thicker than sheets of paper; iron ores of just the same structure very often occur in Grangärde parish, Sweden, and no geologist will at present be likely to defend the hypothesis that iron ores (magnetic or specular) possessing such a structure, can be ejected from the interior of the earth in a hot fluid condition. About twenty feet above the footwall a layer of blackish clay slate, of shale and white clay, (probably impure kaoline), stretching through the ore bed, as far as it is stripped, separates a lower bank of ore from the bulk above. This shale has a thickness of only a few inches, and its gradient decreasing more and more westward in the quarry indicates the same bend of ore bed, which is also intimated by the deflection of the footwall.

Eastward thick slate, making a light-red powder, is prevailing—westward, white clay mixed with grains of quartz and felspar. Very solid and dense iron ore succeeding above this clay strip is overlaid about forty feet above the bottom rock by strata of clay slate, intermixed with peroxide of iron. Thus a second bank of ore is pointed out, of course not so strictly as the lower one, as the adjoining shale has not the white color of the lower strip, and gradually turns into poor, silicious iron ore. A third bank of ore is represented by loose rocks on the surface of the mountain above the quarry. At present it is almost impracticable to determine the exact upper limit (and thickness) of this ore bank.

All the ore strata here described are intersected by numerous parallel fissures, bearing north fifteen degrees east, and dipping eighty to ninety degrees south-east. Other fissures run north fifty-five degrees west, and dip vertically. By these fissures and the planes of stratification, the ore bed is divided into large and small rhombohedral masses, and mining is substantially facilitated. The fissures are very often lined with white and greenish soft mineral matter, probably products of decomposition of the adjoining felspathic rocks.

The rocks of the hanging wall are thick, distinctly stratified layers of gray, red and brown porphyry-conglomerates and breccias, which are intermixed with specular iron ore in isolated, thin, wavy sheets, and alternating with thin strata of felsitic matter, which, being impregnated with peroxide of iron, is black and heavy, making light-red powder. These impregnated strata are prevailing close to and above the ore bed; further up the cliffs iron ore is wanting, or very thinly disseminated, but it appears again more frequently at the highest points of the cliffs, where it forms small seams in the blackish and brown conglomerates. This is a circumstance worth notice, as it intimates the possible existence of a second ore bed in the hanging wall of the one which is mined at present.

The fissures by which the rocks of the hanging wall are intersected have the same bearing as those crossing the ore bed, and they are the first cause of the formation of the cliffs, which at present adorn the summit. The rocks, split along these fissures, form rough, quadrangular pillars, which are partially broken to pieces, according to the planes of stratification. Upright, oblique, and the ruins of scattered pillars cover the summit of Pilot Knob at present. Walking down the western or south-western slope of the mountain, one meets with plenty of rocks rolled down from above, or still in the same place where they were torn from the mountain; and further down one can walk several hundred feet over one and the same unbroken plane of stratification, until a step is reached indicating a succeeding upper layer. But the lower half of the south-western mountain slope is covered with clay. Some diggings have here been made without success. In many places thin strata, impregnated with iron ore, and still thinner sheets of specular iron ore, may be observed in the rocks, which are stripped on the south-western slope; but I have nowhere in this vicinity seen anything deserving the name of ore bed.

The observations here communicated were not made for the purpose of exploring the genesis of Pilot Knob and its ore bed; they can only explain some few of the geological facts, which are of practical interest for successful testing and mining. I cannot fully agree with the opinion expressed in the report of the Geological Survey of Missouri (p. 134): "The base of Pilot Knob, on the northeast, appears to be made up of porphyry and iron ore," no direct observation or conclusion of direct observations authorizing this opinion, as far as the ore is concerned. The foot wall of the Pilot Knob ore bed is plainly unveiled; new and independent ore beds may possibly exist below, but nowhere has their outcrop been observed hitherto. There is only one circumstance intimating the existence of ore-bearing strata below the big ore bed, viz.: loose stones found along the tramway on the northern slope, half way up the mountain. Neither can I agree with a calculation of the ore bulk in Pilot Knob, based on the supposition that the summit-cone covering an area of 53 acres, and rising 141 feet over the quarry (440 feet above the plain around the mountain), were "composed entirely of iron ore," and "would make 108,507,960 cubic feet of iron ore," or 13,972,773 tons (Report of the Geological Survey of Missouri). The summit-cone above the level of 440 feet comprises but the outcrop of the ore bed and part of its hanging wall, which latter cannot be used as iron ore, and of course should not be calculated as such, though it contains thin ore seams and ferruginous strata. The wealth of Pilot Knob is to be sought below the level of this summit-cone. For the rest, Dr. Litton (Report, page 75 a. f.) is quite right in designating the Pilot Knob ore bed as "apparently passing parallel with the lower slaty rocks, and with the same dip through the mountain to southwest." If we suppose for a moment that the ore bed was extended through the whole mountain, from its northwestern to its southeastern flank, and down to the surrounding plain, it would be limited by a hyperbolical line surrounding an area of about 2,380,000 square feet; and if the thickness of the ore bed is supposed to be 50 feet all through the mountain, 119,000,000 cubic feet of ore, or about 15,350,000 tons, would be the contents of Pilot Knob above the surrounding plain. But there are some unpleasant drawbacks. The bulk of ore here calculated contains some strata, which are sterile, or at least not ore worth reducing. Nobody can tell *à priori* whether their thickness is not increasing (and the thickness of the ore-layers between synchronously decreasing) in lower levels, nor whether the *total* thickness of the ore-bearing strata will remain the same in the interior of the mountain as along the outcrop. Swedish ore beds of the same nature as that of Pilot Knob have often been mined to a depth corresponding with the height of Pilot Knob, and commonly they proved to be flat columns, deposited in accordance with the stratification of the surrounding rocks (as far as these are stratified), sometimes swelling and sometimes decreasing, so as to form rows of lentil-shaped bodies. Besides the regularity of these ore beds is impaired by horses, dikes and faults, and if a "conclusio ad analogiam" be permitted, we must expect that the ore deposit of Pilot Knob will show proofs of similar disturbances. As mentioned above, the large Pilot Knob ore quarry is surrounded by an edge of rocks, terminating the extension of the ore bed towards the north-west; of course, in this direction the ore bed does *not* reach the mountain slope, and, as far as I know, its outcrop has not been observed on the opposite southern slope. The ore seems to be accumulated in a kind of "pay chimney," but it is quite possible that several "pay chimneys" may exist in the same ore-bearing stratum north-west or south-east of the ore bed mined at present. In Sweden, a whole series of ore columns is commonly met with in the horizontal extension of an ore-bearing stratum (so-called "malmstreck"), and in general the phenomenon of "pay chimneys" is not limited to fissure veins. Probably the Pilot Knob ore chimney quarried at present will warp southward along the planes of stratification, a supposition which is founded on the fact that no outcrops of ore have been observed on the north-western slope of the mountain, and that the ore vein has not yet been struck by cut No. 3 on the western side of the mountain, though this cut seems to be driven far enough to touch the ore-bearing strata. The horizontal length of the supposed ore chimney must be more than 300 feet, ore being struck on the eastern slope of the mountain, by some cuts about 300 feet from the above-mentioned edge-wall in the quarry. By these cuts the ore was approached from the footwall side. An ore chimney of three hundred feet length, 50 feet thickness, and 815 feet in depth (corresponding to a vertical height of 440 feet and a dip of thirty-three degrees) would yield about 12,225,000 cubic feet, or 1,500,000 tons of ore, and with some degree of certainty we may expect that Pilot Knob, down to the bottom of the valleys, contains more than one and a half millions, and less than fifteen million tons of specular iron ore. In this estimate the existence of independent ore-bearing strata in the foot or hanging wall of the present ore bed is left out of consideration.

It is not my plan to enter the field of genetic speculations, the less as it seems to permit of no doubt that the ore bed with its footwall and hanging wall has been deposited below water, and afterwards metamorphosed; and I am disposed to ascribe a similar origin to the bulk of felsitic rocks which are stripped at the foot of the mountain; but with this I do not intend to question the existence of *intrusive* felsitic or poryphritic rocks, neither in Iron county nor elsewhere. It is very difficult, if not impossible, to arrive at sure conclusions in relation to the intrusive or metamorphic nature of certain rocks, if only their mineralogical qualities can be subjected to examination. In the renowned Dannemora mine the ore bed is surrounded by felsitic rocks (hälleflinta), highly resembling those of Pilot Knob, and considered to be of metamorphic nature; nevertheless the Dannemora ore bed is crossed by (intrusive) dikes of hälleflinta, showing the same mineralogical qualities as the metamorphosed hälleflinta rock around the mine. In the report of the Geological Survey of Missouri, page 155, we find: "Whether this ore has an igneous origin is not so certain; still, the metamorphosed character of the slates with which it is interstratified, the relative position of the Plutonic rocks below and around it, and its similarity to the ores in Shepherd Mountain, Iron Mountain, and the Shut-in, all go to show its igneous origin. If this be true, the main stratum is probably connected with the fissure through which it was ejected. This fissure or vein is to be sought on the south-western side, where the dip of this stratum brings it near the base of the mountain, or within its base"—but I cannot share the genetic view exposed by these sentences.

It will surprise many to hear that formerly the Indian tribes made use of the Missouri iron ores. The aim of many recent patentees to convert iron ores directly into manufactures

by the simplest and shortest processes possible, was reached in the most complete manner imaginable by the red-skins, who, capping DANKS, ELLERSHAUSEN, BESSEMER and SIEMENS-MARTIN, made their weapons directly from ore. In Miller's hotel, Pilot Knob, I saw a heavy tomahawk cut out of a block of iron ore, and polished by grinding. It was reported to be found near the surface, in a cut of the St. Louis Iron Mountain Railroad.

The first attempts to smelt iron in Missouri were made in Washington county, 1823 or 1824, by EVERSOL, PERCY and RUGGLES, who used ores from Clear Creek (hematites). Pilot Knob was not earnestly mined until 1846 or 1847, when the MADISON IRON AND MINING COMPANY erected a furnace at the foot of the mountain. In 1850 the same company established a blomary at Pilot Knob, chiefly for the reduction of Shepherd Mountain ores. In 1854 a second furnace was built. Two hundred and fourteen bushels of charcoal were used to one ton of pig iron, and three hundred and five bushels to one ton (2,464 pounds) of blooms. The annual produce of one furnace was on an average 1,021 tons (to 1854); that of the blomary, 750 tons; but plenty of ore was shipped already in those times along the plank road from Iron Mountain to St. Genevieve on the Mississippi River.* In 1858 Pilot Knob, Shepherd Mountain, and other mineral properties were sold at auction, and the *Pilot Knob Company* was founded, who discarded the blomary and one of the furnaces, making it their chief business to ship ore. The war injured the development of the mines very much, indirectly and directly, the theatre of war now and then being close by, and the little town of Pilot Knob being burnt. Mining on Shepherd Mountain ceased for several years almost entirely. At present six to eight cars of 20,000 pounds are shipped daily from Pilot Knob, making an average of about 19,000 tons a year. But this quantity can be greatly enlarged, and without doubt will be. At present the shipping of ore from the Missouri Iron Mountains is delayed by the high freights on the St. Louis Iron Mountain Railroad, which amount to about 4.7 cents per ton per mile. By the construction of a projected opposition railroad from Pilot Knob or Iron Mountain in a straight line to the Mississippi River, these charges will be reduced, and the shipment increased, as also the shipment northward to Carondelet, along the St. Louis Iron Mountain railroad. The quantity of ore reduced at Pilot Knob furnace can at present not exceed 9,000 to 10,000 tons a year; of course only about 29,000 tons are thus raised annually, while according to other statements the quantity of ore yearly quarried is about 40,000 tons, which is to be increased to 120,000. The mining of the Pilot Knob ore is very simple, as no complicated machinery for draining or hoisting is necessary, the bulky ore being accessible at the outcrop by a broad-faced quarry with the most favorable loose joints in the mass. The wages are low ($1.60 a driller, $2 a driver); transportation to the furnace or railroad is as easy as possible; consequently, the ore must be cheap, if it is quarried by skillful miners under proper inspection. In 1869 the selling price was said to be $2.16 per ton;† about the same is on an average the price of iron ores at the Swedish mines.

The principal quarry extending from east to west, is partly worked downward, in conformity with the dip of the ore bed, and partly along the southern wall of the quarry. In the upper (eastern) part of the quarry, the ore grades are cut away down to the foot-wall; in the western part they will gradually creep under the hanging wall, which, in the long run, it is impossible to remove from the entire surface of the ore bed. The quarrying along the long wall is threatened by similar difficulties, the cliff formations above the ore bed not being stable enough to be left as a roof over rooms, and not yielding ore enough to pay for blasting. For the next years, the flank of these difficulties will be turned by some new cuts, begun from the foot-wall side of the ore bed, south of the large quarry, and, approaching the ore from the western hanging wall by cut No. 3, about four hundred feet above the valley. But it is easily understood that these expedients are palliatives, which should be replaced by systematical underground mining, before overhanging danger, enhanced costs, and declining yield of ore have practically demonstrated their insufficiency. To mine big ore beds regularly, cheaply, with safety for the mines and miners, and without enormous waste of ore, is not quite so easy as it looks to be, and the planning of such work lays claim to all the skill of competent mining engineers.

Three-handed boring is here practised, like in most American mines which I have visited. As a general thing, great profits would be realized if American proprietors of mines would follow the example of their European colleagues, by introducing single-hand, instead of two and three-hand boring, as far as possible. I hope to revert to this chapter at some other time, and will here only explain that two-hand or three-hand drilling is justified at present in the ore quarry of Pilot Knob, where the open faces, the stratification, and fissures permit to blast down two hundred cubic feet and more by one hole. As long as common blasting powder is used, a hole which is to do this work must have a depth of six to eight feet, and a width of two inches, in order to be capable of holding a charge of powder sufficient in volume and height. But holes of six or eight feet in depth and two inches in diameter can practically not be drilled by one man, even if the drillers were skilled miners and not common laborers. It would be different if, instead of common powder, a more powerful explosive material was used, say nitro-glycerine. The holes, not needing the same depth and width as at present to do the same work, could in that case be drilled by single-hand boring.

* These figers are extracted from the Report of the Geological Survey of Missouri.

† According to statements, published in a former letter, the price of Pilot Knob ore at Pilot Knob is only $1.50 currency per ton, and the freight on the St. Louis Iron Mountain railroad $2.31 cents per ton per mile.

The present impracticability of nitro-glycerine is a deplorable drawback for Pilot Knob and many other similar American quarries. I rather think that it would be advisable to do here the same as in a sandstone quarry at Bergzabern, Elsass, where, in a special laboratory, just as much nitro-glycerine is prepared every day as is consumed in the quarry. It must be recollected in this connection that the most disastrous accidents have arisen not by *using* nitro-glycerine, but by *keeping* and *transporting* it.

The laborers in the Pilot Knob ore quarry did not make the impression on me that they overworked themselves, and I cannot wonder at it, as their wages are fixed by the day and not by contract. It is rather surprising to find this arrangement at many American mines, and to hear simultaneously lamentations about high wages, and lazy and disorderly workmen. Clever and assidnous miners will only, much against their will, work together with common people belonging to all possible professions except that of mining; and least if their reward, independent of the work done, is quite the same as that of the idlers. Payment by the day will be always preferred by idlers, and the more the day-wages are reduced, the less will be done and the more expensive will be the work. Some statements about the drilling and blasting effect of the men I dare not reproduce here, because they were not received from officers of the company. Drills entirely of steel are used, and the tools were generally in good condition.

Three tramways are laid out down the slope of the mountain from the quarry. The one furthest to the east, cut at the highest level through the quarry edge, is at present but little used, but will be again, as soon as the eastern cuts yield plenty of ore. The middle tramway, terminating close to the furnace, has a length of about seven hundred yards to the edge, through which it is cut, and enters the middle of the quarry. Two tracks lead to this tramway. The third tramway, terminating over a branch of the St. Louis Iron Mountain railroad, is about two thousand feet long, and runs nearly east and west. It is connected with the lowest western wing of the quarry and with cut No. 3. By the application of a drum with brake of common construction, the loaded cars are lowered, and the empty ones raised, both meeting in the middle of the tramway, where the track is double.

There are some iron ore beds around Pilot Knob, which I have not visited, viz.: Bogy or Buford, five miles south; Big Bogy, Russel, Shut-in, all said to contain specular iron ore, but not worked at present. Shepherd Mountain, one and one-third miles south fifty-one degrees west from Pilot Knob, I have examined, and I intend to describe it in another letter. When I visited Iron Mountain, six miles north of Pilot Knob, the ground was covered with snow, so that only the different cuts could be examined. As the observations made are not in full harmony with the statements made in the Report of the Geological Survey of Missouri, I desire to examine this locality once more, and under more favorable circumstances, before I publish anything in relation to it.

Utilizing the Ammonia from Gas-Water.

Translated from "Deutsche Industrie Zeitung."

IT is proposed by BRADY & BAGGS (English patent) to utilize the ammonia from gas-water with the aid of a current of air, by mixing the water with caustic lime, heating it in a boiler to 40 to 100° Celsius, and forcing atmospheric air through a pipe opening into the bottom of the boiler. Close above the entrance of the pipe, a second bottom, which is full of holes, in order to divide the air properly, is laid in the boiler. From the upper portion of the boiler escapes the air, laden with ammonia and some steam, into receivers filled with water and sulphuric or muriatic acid, which are kept cool. In these the ammonia is retained, while the air escapes. At the Deptford establishment, the cistern for the gas-water is thirty-five feet long, seven feet wide, and six feet deep. The iron boiler used for heating the water is thirty feet long, has a diameter of six feet, and contains four thousand gallons of water. In the bottom of the boiler lie two cast-iron pipes of three inches diameter, which are perforated by many small holes, to permit the entrance and distribution of the air. The air-pumps have a diameter of twenty-six inches, and a stroke of one and two-thirds feet. A stirring apparatus with twelve arms, making eighty revolutions per minute, agitates the liquid. From the boiler the air, laden with ammonia, enters a lime-purifier. This is a wooden vessel of about three hundred and fifty gallons capacity, having a false, sieve-like bottom, and one-third filled with milk of lime. A stirring apparatus keeps the milk of lime in continual agitation. From the purifier the air passes through a cooled worm into a condenser consisting of three vessels. Two of these vessels are one-third full of cold water; the third is filled with a concentrated solution of chloride of iron, which, by the precipitation of oxide of iron, (used after heating it as red paint) is changed to a solution of chloride of ammonium.

SPECTRUM OF THE FIRE-FLY.—Mr. C. A. YOUNG has described in the *American Naturalist* the spectrum given by the common fire-fly as being perfectly continuous, without trace of lines, either bright or dark, and extending from a little above FRAUNHOFER'S line C in the scarlet to about F in the blue, gradually fading out at the extremities. It will be observed that this portion of the spectrum contains the most luminous rays, the calorific and actinic rays not being brought materially into play. This insect, therefore, has the power of generating only those undulations whose velocities are such as to affect most powerfully the organ of vision, and in this respect is a remarkable adaptation of force to precisely the object to be attained. In all devices for illumination by artificial means, many waves, moving both slower and faster than those required, are simultaneously generated, so that but a small portion of the radiant energy is made available to human vision. Yet it may be doubted whether any strong and serviceable light can be produced without a simultaneous generation of the whole range of undulations from the slowest to the most rapid, as found in solar rays.

MINING SUMMARY.

Pacific Mining Review.

A MARKED IMPROVEMENT IN MINING AFFAIRS.

The first quarter of the current year (says the San Francisco *Commercial Herald*, April 8th,) has witnessed a decided advance in mining stocks, accompanied by increased activity in every department of the business throughout the Pacific coast. Early in the year, this improvement, as regards active operations, began to manifest itself; the leading stocks dealt in by the Board of Brokers having, at a later period, commenced to appreciate, and kept steadily advancing, until many of them have reached a higher figure than they had touched for several years before. What constitutes an encouraging, and somewhat anomalous feature of this upward movement, is the fact that it has been based, to a considerable extent, upon an improvement in the condition and prospects of the mines represented, and not solely upon speculative combinations, as has so often been the cast heretofore. Viewed in this light, there is reason to hope that this rise will not prove the forerunner of a sudden fall, or a series of disastrous fluctuations in these stocks, such as have almost invariably happened in years gone by. So far as a number of the leading claims on the Comstock lode are concerned, there has, unquestionably, been a great improvement in their prospects occurred during the past four months; large bodies of superior ore having been developed, in some cases at unexpected points above, and in others, in their lower levels. So important are these discoveries considered, that, taken in connection with other favoring circumstances, they are likely to not only maintain this advance in stocks, but partially reinstate these mines in the public confidence, which, through a combination of untoward causes, they had well-nigh forfeited. The recent completion of a railroad, facilitating the transportation of lumber, fuel and other supplies into these mines, and the carriage of their ores to points affording means for their cheap reduction, has also tended greatly to enhance their value, they having, in common with all other properties of this kind, participated in the benefits accruing from improved machinery, increased skill, and the cheapened cost of labor and the other elements of production. Nor has this appreciation been confined to claims upon the Comstock lode, it having extended, with few exceptions, to productive mines in all parts of the country; being based, as in the case of that great representative vein, upon their generally favorable appearance, and actual capacities. A consciousness of greater security seems to pervade the minds of buyers just now, to a greater extent than has commonly obtained among dealers in these stocks. It is hopeful this will not prove to have been inspired by insufficient cause.

REVIVAL OF ACTIVE OPERATIONS.

But besides this recent stiffening of values, there has been a growing disposition among our people of late, to engage in active mining pursuits—this feeling having manifested itself in a readiness to purchase or expend money for the development of mining properties, for the erection of mills and smelting works, for fitting out prospecting expeditions, or otherwise promoting enterprises of this kind. At no time have all classes of our citizens been more appreciative of our mineral resources, or so generally aroused to the importance of encouraging this interest. It is now perceived, with so many other pursuits languishing, that we shall have to depend largely upon this for the sustenance of our minor industries. Hence, the willingness of capitalists to promote legitimate mining undertakings, and the rapid growth of this business in popular favor.

EXCITING RUMORS AND IMPENDING DANGER OF A MINING STAMPEDE.

With so much attention directed to mining affairs, and such a general depression in most other branches of business, never before could so many men be found ready to set out on the most perilous prospecting tour, if only they could have their expenses paid, or to emigrate to any point promising a chance for earning moderate wages. Under this state of things, we have for several months past been in imminent danger of a mining stampede, the spread of flaming reports of rich discoveries made at different points having meantime well nigh precipitated a crisis of this kind. First came rumors of rich diggings having been found on Peace river, in the northern part of British Columbia. These, though evidently promulgated with a view to starting an emigration that way, failed of that end. Early in the month of March, accounts of startling discoveries having been made in south-eastern Arizona reached San Francisco. Marvelous tales were told of whole mountains of silver found in that region, and for a day or two a great commotion was created in mining circles by these exaggerated stories. After a few days, the actual facts transpiring, this intense but temporary excitement abated, only a few adventurers, instead of several large parties as at one time threatened, having followed the original prospectors on their return to that country. That a number of immensely rich silver-bearing lodes have been found in the locality designated seems probable, though greatly diminished in value by their remoteness from points of supply, and by the hostile character of the Indians inhabiting the region adjacent.

About the same time, news came to hand of very rich gold-bearing quartz having been found in San Diego county, some samples of which having arrived at San Francisco and there being exhibited, attracted much attention, causing several hundred people during the month to emigrate to that section of country. The locality of these mines is on the head-waters of San Diego river, at a point distant by the present wagon road, sixty-five miles north-east from the town of San Diego. They are on the western slope of a mountain range running parallel with the coast, and at an elevation of 4,000 feet above the level of the sea. The country is well timbered and watered, being very similar to the foot-hills of the Sierra Nevada. It also affords good grazing, there being many small valleys and alluvial spots suitable for tillage. The first discovery of auriferous quartz in this vicinity actually dates back to the month of November last, at which time parties crossing the country on their way in from Arizona, having noticed a number of spots showing good rock, determined to stop and prospect more thoroughly. Finding several rich pockets and the indications generally good, they secured by survey and entry, four quarter sections of land covering the mines they had prospected. Having been joined by a few other miners, a district was organized on the 12th of February, and the usual code of mining laws adopted, provision having been made for securing both quartz, placer and tunnel claims. This district, named the Julian, after one of the discoverers of the mines, was laid out ten miles long and four miles wide; another, called the Coldman, ad-

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MARKET REVIEW.

The Coal Trade.

NEW YORK, April 22, 1870.

ANTHRACITE.

WHOLESALE.—The supply of coal to the market during the past week has been small, in consequence of the heavy rains in the various regions damaging the canals and general transportation, also drowning out many of the mines. The "strike" in the Schuylkill region yet continues, which also detains a supply from that direction. There, however, does not seem to be any urgent demand for coal. Lehigh is much called for, but very little is to be had. Schuylkill and Wilkesbarre are also out of market, and as not many are very hungry for the company and miscellaneous coals, very little life is noted in the trade.

The Scranton sale of 80,000 tons of fresh-mined coal of the usual ship and family sizes, is announced in our advertising columns for Wednesday next, the 27th inst., at the usual time and place. This also has a tendency to make matters quiet. We think there will be no change in prices obtained at this sale from that of March, as the amount offered is all the market can well take. If any change takes place a slight advance may be expected. During our gyrations about town to-day we came across a circular of the Pittston Company, with prices to contractors for May, which, if it has any influence on the sale at all, it will give prices an upward tendency.

The recent rains have damaged the Lehigh Canal to the extent of a two weeks' delay in shipments. From our correspondent at Beach Haven we learn that ten days will probably elapse before navigation can be resumed in the Wyoming Canal. The recent rains have also caused considerable damage in the various regions in the way of flooding mines and delaying shipments by high water.

The following dispatch, dated Wilkesbarre, 19th inst., is of importance :

"Owing to the strike of the miners in the Schuylkill region, coal has been shipped from this section to points along the Reading Railroad. Yesterday the miners at Plymouth refused to load Reading cars, and all the colliers stopped work, and would not resume until the operators promised to load no more cars for the Reading road. The men will not do anything to relieve the wants of the Schuylkill operators or supply their customers with coal. The men in the Lehigh region refuse to strike, and the work is going on as usual."

Prices remain firm, but unchanged, quotations remaining the same as last week.

RETAIL.—The retail trade remains very quiet, owing to the warm weather.

Our Philadelphia correspondent writes: "The coal trade is very dull ; no stock on hand, and the home market very bare. The Schuylkill operators are yet very firm, and will probably hold out for some time to come. There is not much demand from the East, and the shippers are taking matters very easy."

ITEMS.

The Cumberland trade is dull, but the stocks are small, and as many believe that prices will not go materially lower, holders prefer stocking to selling at reduced rates.

The Shamokin *Herald*, one of the best of our exchanges, thus reviews matters in its district, under date of the 21st inst. : "The suspension continues in our region, with as little prospect of resumption as when the stoppage first occurred. This contest between operators and miners is somewhat similar to the North and South in the late rebellion—it is a question of endurance. The operators appear to be more united now than ever, while the men seem to be preparing for a long campaign. Some have gone elsewhere to work, a great number are working on the township roads, while others are fixing up their properties or doing petty jobs about the town.

The Bear Valley and Burnside collieries, which were worked by men not connected with the Union, have stopped.

The only collieries in our county now running are the Cameron, Frank Gowen, Luke Fidler, Ben Franklin, Big Mountain, Coal Ridge, Trevorton, and one or two small operations. The first four are worked by miners who do not recognize the W. B. A. The principal portion of coal mined is sent West.

We take occasion to notice the progress of the slope now being sunk at Lancaster colliery by the Shamokin Coal Company, under the management of F. J. Anspach, Superintendent. This slope is on the twin veins, and is being pushed forward with great vigor—three shifts per day working upon it. The face is now some 75 yards below the old water level gangway, presenting a vein of eight feet of most excellent coal. Competent judges say that this improvement, when completed, will be one of the finest in the county.

The Wilkesbarre *Record of the Times* says : The substitution of Delaware and Hudson locomotives on the Plymouth and Wilkesbarre Railroad bridge indicates that that company has obtained control of that link between the east and west side of the river. It is said that the charge for transferring trains is one dollar per car, and that the Lehigh Valley and Lehigh and Susquehanna Railroads have engineers above and below it, running lines with purpose of new connections between their roads and the Lackawanna and Bloomsburg road. If, as we suggested last week, the west side of the river has three-quarters of a million tons of coal for new routes, it may be worth while to build at least one more bridge to reach it, The application to the Legislature for power to sell a portion of the Nanticoke Railroad to the Wilkesbarre Coal and Iron Company looks like further changes in the coal business.

Last summer the stock of the Coal and Iron Company, which had been absorbed by the Lehigh Coal and Navigation Company, was purchased for the Coal and Iron Company again, with the provision for a transfer of part of the Nanticoke road passing their mines. The purchase of the real estate now leased by the Coal and Iron Company was not consummated, the stockholders of the Hollenback Coal Company refusing to confirm the contract. The Delaware and Hudson Canal Company use part of the Nanticoke road in their trade North and South. We should like to see a kindly feeling between this company and the Lehigh Coal and Navigation Company ; for in spite of the growing jealousy of large corporations and monopolies, we feel pride in them as pioneers of the trade in our county, which have grown great under our own notice and supervision. It is nearly forty years since the name of Carbondale in the newspapers first attracted our attention, and we have seen the struggling enterprise attain mammoth proportions, and confess to a good deal of pleasure at the success of the company, along with fears of its power.

We must not lose sight of the benefits conferred by the large companies while criticising what may seem to be abuses. The country would have long remained a wilderness without them.

BITUMINOUS COALS.

There is about a fair proportion of business doing in Cumberland coals for manufacturing and steam purposes.

Anthracite Coal Trade for 1869 and 1870.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending April 16, 1870, compared with week ending April 17, 1869.

COMPANIES.	1869. WEEK.	1869. TOTAL.	1870. WEEK.	1870. TOTAL.
*Phila. & Reading R.R	92,313	956,057	36,397	708,054
Schuylkill Canal	23,515	89,744	3,932	18,719
Lehigh Valley R. R., N			7,911	88,921
" " " S	67,368	837,147	57,546	916,637
Lehigh and Sus. R. R.	15,416	231,945	19,977	247,638
Lehigh Canal	28,794	63,984	13,111	19,867
Scranton North	11,063	149,633	12,001	178,464
" South	30,675	443,917	37,564	492,682
Penn. Coal Co., rail	20,749	217,135	27,160	278,161
" " " canal	116	116	236	236
Del. and Hud. Canal,	47,740	82,946	56,805	65,415
" " " rail, N	5,053	78,811	8,309	166,475
" " " south	2,930	27,580	7,521	75,706
Shamokin	8,770	96,647	7,999	80,538
Treverton	824	6,332	2,333	70,003
Lykens Valley Coal Co.	811	12,497		
Wyoming South			570	570
" North				
P. N. Y. C. & R. R. Co.			7,911	89,404
Williamstown, Col'y	2,561	39,330	6,102	69,019
Short Mountain	2,590	18,434		
Total	361,118	3,352,565	303,438	3,546,089
1870	303,438			3,352,665
Decrease week and year	57,680		Incr'se	293,524

* Less coal transported for Company's use and Bituminous coal.

Bituminous Coal Trade, 1869 and 1870.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending April 16, 1870, compared with week ending April 17, 1869.

COMPANIES.	1869. Week.	1869. Year.	1870. Week.	1870. Year.
B. & O. R. R.			6,150	
C. & O. Canal			18,862	
H. & B. T. R. R.	6,390	86,274	8,207	74,223
Harrisburg & D.			14,267	131,830
L. V. R. R.				4,292
P. & N. Y. C. & R. Co.			3,852	59,759

Schuylkill Coal Trade.

Report of Coal transported via the P. and R. R. for the week ending April 14, 1870—less coal carried for Company's use, and Bituminous Coal:

For week	26,397 03
Previously this year	771,657 03
Total	798,054 06
Same time last year	956,057 00
Decrease	158,002 14
Amount sent same week 1869	94,313 00

Report of coal transported on the Philadelphia and Reading Railroad for the week ending Thursday, April 14, 1870 :

From St. Clair	6,333 15
" Port Carbon	1,428 07
" Pottsville	42 04
" Schuylkill Haven	11,596 19
" Auburn	1,209 07
" Port Clinton	3,362 13
" Allentown and Alburtis	2,403 18
" Harrisburgh and Dauphin	14,257 06
Total paying freight	40,664 09
Coal for Company's use	1,643 17
Total for week	42,308 06
To same time last year	962,251 03
Total	994,559 09
To same time last year	1,054,349 18

Report of coal transported over the Schuylkill Canal for the week ending Thursday, April 14, 1870.

	Tons. Cwt.
From Port Carbon	348 04
" Pottsville	181 00
" Schuylkill Haven	3,403 15
" Port Clinton	
Total for week	3,932 19
Previously this year	14,786 13
Total	18,719 07
To same time last year	89,744 15

Harrisburgh and Dauphin Coal Trade.

The following is the amount of Bituminous Coal transported via the P. and R. R. for the week ending April 14, 1870 :

	Tons.
For week	14,267 06
Previously this year	137,563 09
Total	151,830 15

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company, for week ending Saturday, April 16, 1870.

	WEEK.	SEASON.
North	46,452 18	631,363 06
South	7,523 12	75,766 04
Total	53 976 10	707,129 10
Corresponding time in 1869.		
North	40,372 15	538 202 04
South	2,959 12	25,842 16
Total	43,332 07	564,045 00
Increase North	6 080 03	Increase 93,161 02
Increase South	4,564 00	Increase 49 923 08
Total Increase	10,644 03	Increase 143,084 10

Report of Coal Transported by the Lehigh Coal and Nav. Co.'s Railroads and Canals,

Week ending April 16, 1870—Compared with same time last year.

WHERE SHIPPED FROM	WEEK, 1870. tons ct	WEEK, 1869 tons ct	YEAR, 1870. tons cwt.	YEAR, 1869. tons cwt.
Wyoming Region	28813 04	19116 04	24835 03	168587 10
Upper Lehigh Region	3891 03	3334 09	22613 05	46857 15
Mahanoy Region		146 15		146 15
Hazleton Region	5765 09	6945 12	10120 05	20393 14
Beaver Meadow Region	3557 15	3459 09	5814 14	9155 04
Mauch Chunk Region		10431 19	30089 18	76353 08
Totals	41827 11	45854 08	316991 05	321394 06
Increase				
Decrease	4126 17		4403 01	
DISTRIBUTION.				
Forwarded East of Mch Chunk by Rail	19977 10	15416 03	247038 11	231945 19
Forwarded East of Mch Chunk by Canal	13111 04	28794 03	19867 02	63904 01
Delivered at and above Mauch Chunk	1137 13	972 00	10084 06	11487 17
Delivered to L. & B. R. R. at Plymouth Bridge	7601 04	701 08	39401 06	8956 06
L. V. R. R. at Sugar N.		70 14		5100 03
Totals	41827 11	45954 08	316991 05	321394 06
Of the above there was from Mines controlled by Co., W.B.C. & I.Co	9620 06	9176 17	91928 12	82678 01
L. C. & N. Co	1622 02	10800 11	44467 02	76353 08
Totals	11242 08	19977 08	136395 14	159031 09
Increase				
Decrease	8735 00		22655 15	

Report of Coal Transported over Lehigh Valley Railroad

For the week ending April 16, 1870, and previously this season, compared with same time last year :

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	PREVL'Y. Tons. Cwt.	TOTAL. Tons. Cwt.
Total Wyoming	14,863 10	200,587 12	215,451 02
" Hazleton	44,026 00	511,571 19	555,597 19
" Upper Lehigh	1,073 02	2,709 12	3,782 14
" Beaver Meadow	15,244 13	148,224 17	163,469 10
" Mahanoy	1,940 00	89,935 17	91,875 17
" Mauch Chunk		447 17	447 17
Total Anthracite	75,147 05	973,477 14	1,048,624 19
Bituminous Coal recv'd from Cata. R. R.			
N. C. R. R.			
E. P. R. R.		4,292 00	4,292 00
P. & N. Y. C. & R.R. Co			
Fall Creek			
Schroeder			
Towanda			
Total by rail and canal	75,147 05	977,769 14	1,052,916 19
Same time last year	67,368 09	769,779 05	837,147 14
Increase	7,778 16	207,990 09	215,769 05
Decrease			
Forwarded East from M'h Chunk by rail	57,546 08	859,090 19	916,637 07
Same time last year	53,394 08	718,117 10	771,511 18
Increase	4,152 00	141,973 09	145,125 09
Decrease			

RECAPITULATION.

Forwarded East from M'h Chunk by rail	57,546 08	859,090 19	916,637 07
To N. C. R. R., at Mount Carmel		115 00	115 00
Forwarded North from L. & B. Junction	7,911 04	81,009 18	88,921 02
To L. & S. R. R. at Packerton for rail	150 06	2,920 16	3,071 02
Delivered at M'h Chunk	39 19	467 08	507 07
Delivered on line of road above Mauch Chunk	194 15	5,699 01	5,893 16
Delivered above M. Chunk for use of L. V. R.R.	589 15	18,874 15	19,444 10
To L. & S. R. R., at P'n Hav., for railroad			
Do. for canal	5,177 03	2,308 07	7,485 10
At M.Chunk for canal	3 557 15	2,991 10	6,549 05
Total Anthracite	75,147 05	973,477 14	1,048,624 19
Bituminous Coal		4,292 00	4,292 00
Total all kinds	75,147 05	977,769 14	1,052 916 19

Penn. and N. Y. Canal and Railroad Co.

REPORT of Coal Transported via the Pennsylvania and New York Canal and Railroad Company, for week ending April 16, 1870 :

	WEEK.	PREVIOUSLY.	TOTAL.
Anthracite	7,911 04	81,493 03	89,404 07
Bituminous	3,852 00	55,907 00	59,759 00
Total, Ant. and Bit.	11,763 04	137,400 03	149,163 07

Cumberland Coal Trade.

B. & O. RAILROAD.

The shipments over the Baltimore & Ohio Railroad for the week ending April 16, 1870, were as follows :

From Georges Creek via Piedmont.	Tons.
Consolidation Co	3,039 02
Borden Co	1,150 14
Midlothian Co	3.9 14
Hamp. & Balt. Co	
From Eckhart R. R.	
C. C. & I. Co	1,521 16
Spruce Hill Company	389 07
Total	6,150 14

Coal Trade by Canal.

For the week ending April 16, 1870, there were cleared at the port of Cumberland 170 boats laden with coal, shipped by the several companies, as follows :

American	3,978.03
Borden	1,778.04
Consolidation (194.11 to Antietam)	2,872.19
do Eckhart Mines	985.08
Hampshire & Baltimore	1,131.18
Maryland	4,195.16
Midlothian	333.10
James Boyce (from Eckhart)	1,455.07
R. G. Rieman & Co., do	1,462.16
Mayfield & Hieston (from H. & B.)	327.08
B. McQuade (Cooke Mine)	111.10
T. Gilleese, Hancock (Maryland)	118.15
C. Embrey & Son, Williamsport	107.09
	18,862.13

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven $2 00

From Port Carbon, 8 cents per ton more.

Less drawback of 80 cents on all Coal shipped east of New : runswick and south of Cape Henry.

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Easton	$ 81
C. R. R., N. J., Easton to Elizabethport	1 12
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 28

MAUCH CHUNK TO PORT JOHNSON.

L. V. R. R., or L. & S. R. R. from M. C. to Easton	$ 81
C. R. R., of N. J., Easton to Pt. Johnson	1 19
Shipping expenses	25
Wharfage	10
Total	$2 35

TO HOBOKEN.

L. V. R. R., Mauch Chunk to Easton	$ 81
Morris & Essex R. R. Easton to Hoboken	1 19
Shipping expenses	25
Wharfage	10
Total	$2 35

TO SOUTH AMBOY.

L. V. R. R.	81
B. & D. R. R.	
Cam. & Am. R. R.	1 09
Shipping Expenses	25
Total	$2 15

PENN HAVEN TO ELIZABETHPORT.

L. V. RR. Penn Haven to Easton	95
C. RR. of N. J. Easton to Elizabethport	1 19
Shipping expenses	25
Wharfage	10
Total	$2 49

BY CANAL.

Via Schuylkill Canal.

TO PHILADELPHIA.

From Schuylkill Haven	$1 07
" Port Carbon	1 10
" Port Clinton	1 00

TO NEW YORK.

From Schuylkill Haven	$1 70

Via Lehigh Canal.

TO PHILADELPHIA.

Lehigh Canal	$0 70
Freight and towage	1 07
Total	$1 77

TO NEW YORK.

Lehigh Canal	$ 40
Morris "	1 10
Freight	
Towing	
Total	$ 2,50

TO JERSEY CITY.

Lehigh Canal	$ 40
Morris "	2 00
Freight	
	2 40
For re-shipment	2 20
Total	$

Via Delaware and Raritan Canal.

TO NEW YORK.

Lehigh Canal	$ 40
Delaware Division Canal	30
Delaware and Raritan Canal	35
Freight	1,25
Towage	20
Total	$ 2,50

TO NEW BRUNSWICK.

Lehigh Canal	$ 40
Delaware Division Canal	30
Delaware and Raritan Canal	35
Freight	1.05
Total	$ 2,10

For Re-shipment—30 extra for shipping, and 10 cents. drawback.

Towing Rates.

TO EASTERN PORTS.

	Per Ton.
To New Haven	$ 40
Bridgeport	40
Southport	40
Westport	40
Norwalk	40
Stamford	40
	Per Boat.
Greenwich	$70 00
Port Chester	80 00
Mamaroneck	70 00
Glen Cove	55 00
New Rochelle	55 00
East Chester	60 00
West Chester	30 00
White Stone	30 00
College Point	25 00
West Farms	25 00
Flushing	30 00
Harlem and Mott Haven	20 00
Port Morris	20 00
Ninety-first street and Astoria	16 00

Boats beyond Port Chester, with less than 200 tons, $80 per Boat.

TO RIVER PORTS.

Boats of 150—250 Tons.	Per Ton.
To Manhattanville	8 cents
Spuyten Duyvil	8 "
Yonkers	9 "
Hastings	10 "
Piermont	12 "
Dobbs' Ferry	12 "
Nyack	14 "
Tarrytown	15 "
Sing Sing	16 "
Croton Landing	17 "
Haverstraw	17 "
Verplanck's	17 "
Peekskill	18 "
West Point	20 "
Cold Spring	20 "
Newburgh	18 "
Poughkeepsie	22 "
Rondout	23 "
Boats of 100 Tons	Per Boat.
To Manhattanville, and Return	$11 00
Spuyten Duyvil, "	13 00
Yonkers, "	15 00
Sing Sing, "	20 00
Peekskill, "	25 00

Freights.—APRIL, 1870.

TO EASTERN PORTS.	From Philadel'a.	From E. Port and Port Johnston.	From Weehawken	From Rondout
Amesbury	$2 75	$— —	$	$
Bangor	2 75	— —	1 90	
Bath	2 75	2 00	2 10	
Boston	2 25	1 85	2 00	
Bridgeport	1 65	1 00	1 20	
Bristol	2 00	1 40	1 45	
Cambridgeport	2 50	2 00	2 15	
Derby	2 00	— —		
Dighton	— —	— —	1 50	
East Cambridge	2 50	2 00		
Fall River	1 75	1 40	1 45	
Hackensack	1 95	1 50		
Hartford	2 75	1 50		
Jersey City	1 75	50		
Middletown	— —	1 25		
Mystic	2 00	1 40	1 35	
New Bedford	1 75	1 50		
Newburyport	2 50	2 00	2 10	
New Haven	1 70	1 00	1 20	
New London	2 00	1 20	1 30	
Newport	1 75	1 40	1 45	
New York	1 25	50	70	
Norwalk	1 75	1 00	1 15	
Norwich and tow	1 75	1 40	1 40	
Pawtucket	2 00	1 50	1 65	
Portland	2 25	1 80		
Portsmouth, N. H.	2 25	2 15	2 05	
Providence	1 75	1 40	1 50	
Rockport	2 10	— —		
Saco	2 50	2 10		
Sag Harbor	2 00	1 40	1 35	
Salem	2 25	2 00	2 15	
Stamford	2 00	1 00	1 10	
Stonington	2 00	1 40	1 30	
Taunton	2 75	2 00		
Warren	— —	1 40	1 50	
Washington	1 00			
TO RIVER PORTS.				
Albany		1 00	- 60	
Catskill		— —	- 50	
Cocksackie		— —	- 50	
Coeyman's		— —	- 75	
Cold Spring		— —	- 35	
Fishkill		— —	- 30	
Haverstraw		50	- 60	
Hudson		— —	- 50	
New York		— —	- 70	
Nyack		50	- 60	
Poughkeepsie		— —	- 35	
Rhinebeck		— —	- 30	
Rondout		— —	— —	
Saugerties		— —	- 40	
Sing Sing		— —	- 60	
Stuyvesant		— —	- 55	
Tarrytown		80	- 75	
Troy		1 00	- 75	
West Point		— —	- 35	
Yonkers		40	- 60	

Foreign and Provincial Freights.

April, 1870.

Foreign.	
Newcastle and Ports on Tyne, per keel of 21 1-5 tons	£13 10@£14 10
Liverpool	12s.6d@14.ton
TO NEW YORK.	
Provincial	
Sidney	$
Lingan	
Cow Bay	
Port Caledonia	
Little Glace Bay	
TO BOSTON.	
Sydney	$
Lingan	
Cow Bay	
Port Caledonia	
Little Glace Bay	

Prices of Coal by the Cargo,

[CORRECTED WEEKLY.]

	AT NEW YORK, April 22.		AT PHILADELPHIA, April 21.	
SCHUYLKILL.	R. A.	W. A.	R. A.	W. A.
Lump	$— —	$5 00	4 50	— —
Steamer,	— —	5 25	— —	— —
Broken,	— —	— —	— —	4 50 to — —
Egg	5 75 to 6 25	5 50	— —	4 50 to — —
Stove	— —to —	6 00	— —	4 50 to — —
Chestnut	4 50 to 5 40	5 00	—	4 00 to —
Pea	— —	— —	— —	— —
LEHIGH.				
Lump, (along side)	6 00	— —	— —	— —
Broken	6 00	— —	— —	— —
Egg	6 00	— —	— —	— —
Stove	6 25	— —	— —	— —
Chestnut	5 50	— —	— —	— —
Pea	— —	— —	— —	— —
SPECIAL COALS.*				
Diamond Vein	R. A.	— —	— —	— —
New England	"	— —	— —	— —
Locust Dale	W. A.	— —	— —	— —
Honey Brook, Le'h	W. A. 4 75 to 5 75		— —	— —
Spring Mountain	" " 4 75 to 5 75		— —	— —
Sugar Creek	" " 4 75 to 5 75		— —	— —
Sugar Loaf	" " 4 75 to 5 75		— —	— —
Old Comp'y's.	" " 4 75 to 5 75		— —	— —
Cross Creek	" " 4 75 to 5 75		— —	— —
Enterprise	" "	— —	— —	— —
Girardville	" "	— —	— —	— —
McMichael	" "	— —	— —	— —
Shamokin	" "	5 50	4 50	— —
Lykens Valley	" "	— —	— —	— —
Broad Top	" "	5 50	— —	— —
Hill & Harris	" "	— —	4 50	— —
Henry Clay	" "	— —	4 50	— —
Powelton	" "	5 50	4 50	— —

Prices for Coal at Mauch Chunk.

	F.L.	Bro.	Gra.	Eg.	Sto.	Cst.
Lehigh	$3 50	$3 50	$3 50	$3 50	$4 00	$3 25
Wilkesbarre	3 50	3 50	3 50	3 50	4 00	3 25

For freight to Elizabethport and to New York see "Freights."

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein..f.o.b. at Phila	$5 00
Lemon " "	4 75
Cumberland Vein Coal	5 00
Cumberland C. & I. Co.'s on board	N. Y. 7 00
Maryland Coal Co. "	7 00
Consolidated Coal Co.'s "	7 00

[*Dealers in these coals may be found in our advertising columns.]

Company Coals.

	L.	Str.	Gra.	Eg.	Sto.	Ches.
Scranton at E. Port	4 50	4 60	4 75	5 00	5 75	4 60
Pittston at Newburgh	4 50	4 50	4 55	4 60	5 25	4 40
Lackawana at Weh'kn.	5 00	5 15	5 40	5 65	6 15	5 00
Wilk'b're at Hoboken	4 75	4 75	4 95	5 25	5 75	4 75
Old Co. Lehigh at Pt. Johnston	— —	— —	— —	— —	— —	— —
Lehigh at E. Port	5 50	5 25	5 25	5 25	5 75	4 75

For freights to different points, see "Freights."

Prices of Foreign Coals.

April, 1870.

Duty $1 25 per ton.

Corrected weekly by PARMELE BROS., No 32 Pine street, New York.

Liverpool Gas Caking	$ 8 00@— —
" " Cannel	10 00@12 00
" House "	13 50@15 50
" " Orrel	12 00@14 00

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$18 00@17 50
" " Cannel	18 00@20 00

Per ton 2,000 lbs., delivered

Prices of Gas Coals.

April, 1870.

PROVINCIAL.

Corrected weekly by Louis J. Belloni, Jr. 73 Pine st., N.Y.

Duty, $1 25, gold.

	Coarse.	Slack.
Block House	$1 75	@- 75
Gowrie	1 75	@- 75

Corrected by Bird, Pickens & Job, 86 South street.

	Coarse.	Culm of Coal.
Pictou	$2 25	@1 25
Sydney	2 25	@- 80
Lingan	1 75	@- 80
Little Glace Bay	1 75	@1 00
Caledonia	1 60	@- 80

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty $1 25 per ton, gold, on the coarse coal. 25 per cent. ad valorem on the Culm of Coal.

AMERICAN.

	Coarse.	Slack. Currency.
Fairmount Gas Coal Co. of N. Y.	7 50	@- —
Despard Coal Co	$7 50	@- —
Penn	— —	@- —
Newburg Orrel Gas	— —	@- —
West Fairmount Gas Coal	— —	@8 00

AT PHILADELPHIA.

Powelton $7 80

Prices at Baltimore—April, 1870.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$6 00@6 75
Pittston and Plymouth	6 00@6 50
Shamokin Red or White Ash	6 00@6 25
Lykens Valley Red Ash	— —@6 50
Zerba Valley	6 00@6 25
Trevorton, Red Ash	6 00@6 50
By retail, all kinds per ton of 2240 lbs.	7 25@8 50
Georges Creek & Cumberland f. o. b. at Locust Point for shipping	— —@5 00
West Fairmount Gas f. o. b.	6 00@6 50

Prices at Georget'n, D.C., & Alexandria, Va.

April, 1870.

George's Creek and Cumberland f. o. b. for shipping..$4 75

Prices at Havre de Grace, Md.

Wilkesbarre and other White Ash for cargoes	$— —@— —
Lykens Valley	— —@— —
Shamokin Red or White Ash	— —@— —
Trevorton and Zerba Valley	— —@— —

METALS.

NEW YORK, April 20, 1870.

IRON.—Duty: Bars, 1 to 1½ cents ₱ lb; Railroad, 70 cents ₱ 100 lbs.; Boiler and Plate, 1½ cents ₱ lb; Sheet, Band, Hoop, and Scroll, 1¼ to 1¾ cents ₱ lb; Pig, 9 ₱ ton; Polished Sheet, 3 cents ₱ lb.

	Store Prices.
Pig, Scotch No. 1, ₱ ton	32 50@35 00
Pig, American, No. 1	33 00@34 —
Pig, American, No. 2	31 —@32 —
Pig, American, Forge	30 —@31 —
Bar, Refined, English and American	— —@75 00
Bar, Swedes, assorted sizes (gold)	85 00@97 50
Bar, Swedes, ord'y sizes, less 5 ₱ ct.	115 —@125 —
Bar, Refined " "	77 50@ — —
Bar, Common " "	72 50@ — —
Scroll " "	87 50@115 —
Ovals and half-round " "	95 —@110 —
Band " "	95 —@ — —
Horse Shoe " "	95 —@ — —
Rods, ⅜ to 3-16 inch " "	85 —@120 —
Hoop " "	105 —@145 —
Nail rod, less 5 ₱ ct.	— 7 —@7¼
Sheet, Russia, as to Nos. (gold)	— 11—@—12—
Sheet, Single, D. and T. Common	— 4¾@— 6¾
Sheet, Galv'd, Nos. 14 to 25 List 15, 16 and 17 c.	25@30 ₱c. off
Rails, English (gold), ₱ ton	59 00 @60 00
Rails, American, at Works in Pa	71 00 @73 00

STEEL.—Duty: Bars and ingots, valued at 7 cents ₱ lb or under, 2½ cents; over 7 cents and not above 11, 3½ cents ₱ lb; over 11 cents, 2½ cents ₱ lb, and 10 ₱ cent ad val. (Store prices.)

English Cast (2d and 1st quality) ₱ lb	— 16 @— 20
English Spring (2d and 1st quality)	— 7 @— 10
English Blister (2d and 1st quality)	— 11 @— 18
English Machinery	— 13½@— 14
English German (2d and 1st quality)	— 13 @— 15
American Blister "Black Diamond"	— — @— 12
American, Cast, Tool do.	— — @— 18
American, Spring, do.	— 9 @— 12
American Machinery, do.	— — @— 12
American German, do.	— 10 @— 12

COPPER.—Duty: Pig, Bar, and Ingot, 5; old Copper 20 cents ₱ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ₱ lb	— @— 31
Copper Bolts	— @— 31
Copper Braziers, 16oz. and over	— @— 31
Copper Nails	36 @— —
Copper, Old Sheathing, &c., clean	17 @— 18
Copper, Chili Pig	— @— —
Copper, American Ingot	19 @— 19¾
Yellow Metal, New Sheating	24 @— —
Yellow Metal Bolts	24 @— —
Yellow Metal Nails	— @— 24

LEAD.—Duty: Pig, $2 ₱ 100 lbs.; old Lead, 1½ cents ₱ lb; Pipe and Sheet, 2½ cents ₱ lb.

Galena, ₱ 100 lbs	$— — @— —
Spanish (gold)	6 20 @6 25
German, do.	6 20 @6 37½
English, do.	6 20 @6 62½
Bar (net)	— — @ 7 70
Pipe and Sheet (net)	— — @ 7 70

TIN.—Duty: Pig, Bars, and Blocks, 15 ₱ cent. ad val.; Plate and Sheets and Terne Plates, 25 ₱ cent. ad val.

	Gold ₱ lb.
Banca	— @37½
Straits	— @34
English	— @34

PLATES.

	Fair to Good Brands.	Gold.	Currency.
I. C. Charcoal, ₱ box	$8 25	@8 50	$9 75 @10 00
I. C. Coke	6 50	@7 25	7 75 @ 8 75
Coke Terne	5 75	@6 00	6 75 @ 7 —
Charcoal Terne	7 25	@7 75	8 50 @ 9 75

SPELTER.—Duty: In Pigs, Bars, and Plates, $1 50 ₱ 100 lb.

	Gold.
Plates, Foreign, ₱ 100 lbs.	$6 00 @6 12½
Plates, Domestic, ₱ lb.	10 @- 11½

REMARKS.

IRON.—There has been an improved demand for Scotch Pig, and the advance noted in our last is fully supported; the sales are 300 tons Eglinton at $32 50@33; 200 do. Gartsherrie, $34; 150 do. Glengarnock, $34, now held at $34 50; and 100 do. Coltness, to arrive, at a private gold price. American remains inactive; we quote nominally No. 1 $33@34, and No. 2 $31@32. Wrought Scrap continues in active request, and prices have slightly appreciated; 1,050 tons No. 1, from yard, sold at $40@41, and 150 do. old Car Wheels, $38. There is a steady demand for new English Rails at $59@60 gold; American are neglected, and have declined to $71@72 currency at the works in Pennsylvania; the sales are 1,000 tons 50-lb. English, $59 50; a small lot of American, $71; and 550 tons old Double-Headed, on private terms. Bar from store continues very quiet, but prices are unchanged—manufacturers are doing little or nothing, holding refined even higher in Philadelphia, than it can be bought at here.

LEAD.—The market for Pig, though quiet, is steady and firm; $6 25 gold is now generally demanded for ordinary qualities Foreign. Bar, Pipe and Sheet are steady at $67 70 per 100 lb. net cash.

COPPER.—New Sheathing is steady at 31c., and Yellow Metal 24c. cash. Ingot is dull, there is no speculative demand. Manufacturers and dealers buy only as their immediate wants require, and prices are still relatively above those current in the European markets, so that there is no outlet to any considerable extent in the way of shipments; the season for receipts from the Lake regions is also at hand, and, under these unfavorable influences, prices are not very strong; sales have been made of 150,000 lb. Lake Superior at 19¼@19½c., the latter an outside figure, and 25,000 lb. at a reserved price.

TIN.—There is no stock of Pig either in importers' or speculators' hands, so that dealers are the only sellers. Prices are firm, and a little higher again, but the advance here does not keep pace with the upward movement in the European markets, the latest telegrams from London quoting Straits £133, and English £135. We notice sales of 250 slabs Straits at 33½c.; 200 do., 34c.; and 18 tons English, 33@33½c., now held at 34c. Banca nominally 37½c., all gold. In Plates there is less movement this week, but the market generally is quite firm, the tendency being rather in sellers' favor, the market sympathizing, to some extent, with the recent considerable rise in England in the price of Pig. Sales have been made of 250 bxs. Charcoal Tin, a choice brand at $8 62½, and 500 do. I. C. Coke, 14 by 20, $7 25, both gold.

SPELTER.—Foreign remains in the same stagnant position, and prices are quite nominally as before, say 6@6½c. gold.

ZINC.—American Ox. Zinc, 6½ @ 7c.; French do., 10 @ 10½c.; Sheet Zinc, 9 @ 10c.

MANGANESE—Ox. Manganese, 4 @ 4½c. per lb.

Mining Stocks.

NEW YORK, April 20, 1870.

The quotations of Mining stocks are not materially altered since our last report. Sales of Quartz Hill were effected this P.M. at 28 @ 27 cents; Grass Valley at 21 cents, and Central Gold at 23 cents. Reference to our quotations elsewhere will give the condition of the market to date.

Large sales of United Petroleum Farms were reported this A.M. at 25 cents, and Bennehoff Run at 30 cents. The following is the latest report of the Stock Board:

	Bid.	Asked.
Bennehoff	29	31
Bergen Coal and Oil	40	50
Bliven Oil	30	1 00
Brevoort	1 00	— —
Buchanan Farm	43	45
Central	55	56
Clinton Oil	— —	@3 50
Home Petroleum	4 00	— —
National	— —	— —
N. Y and Alleghany	— —	— —
Northern Light	60	1 00
Pithole Creek	1 25	1 50
Rathbone	25	—
Rynd Farm	30	35
Second National	50	—
Tarr Farm	— —	— —
Sherman & Barnsdale	10	—
United Petroleum Farms	23	26
United States	72	80

San Francisco Stock Market.

A telegram, dated San Francisco, April 20, reports sales of Gould & Curry at $1 55 @ 1 37½, that being the only report received since our last, and but for which we might be justified in the conclusion that the San Francisco Stock market was extinct.

SAN FRANCISCO, April 19, 1870.

(By Telegraph.)

	1st Board.	2d Board.
Savage	55	55½
Crown Point	—	—
Yellow Jacket	49¾	50½
Kentucky	86	85
Chollar Potosi	—	30
Gould & Curry	1 55	1 37½
Ophir	—	—
Alpha	—	—
Belcher	25	24½
Imperial	48	—
Hale & Norcross	—	—
Amador	—	—

Fire at Mahonoy.

AN incendiary fire, last Saturday week, at Mahanoy, Pa., destroyed the breaker of E. SELLIMAN & Co. Two new engines of sixty horse power were also destroyed. The loss was about sixty thousand dollars, which was one-third covered by insurance.

MINING COMPANIES AND STOCK QUOTATIONS.

GOLD AND SILVER COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
Alameda Silver		A. Queran, 108 Wall st.	$2,000,000	$10 00		
Ada Elmore	South Boise, Idaho					
American Flag	Nevada District, Col.	P. P. Fullerton, 71 B'way	600,000	10 00		
Atlantic and Pacific	Humboldt Co., Nevada					
Bates and Baxter	Colorado			50 00		
Benton	Colorado	W. F. Drake, 15 Broad	500,000	5 00		
Briggs	Colorado	J. P. Davies, 19 Cliff	1,000,000	100 00		
Black Hawk	Colorado	C.T.Whittington, 48 Broad	2,500,000	100 00	27	40
Bobtail	Colorado	J. Stanton, Jr., 25 Nassau	1,000,000			
Bullion Consolid'ed Gold	Colorado					
Burroughs Gold	Colorado					
Central Gold					23	25
Consolidated Gregory	Colorado				1 60	1 65
Combination Silver	Nevada			100 00		1 50
Columbia Silver	Austin, Nevada	J. M. Brown, 155 B'way	5,000,000			
Commercial Silver		J. E. Smith, 26 Pine	3,000,000			
Corydon	Gilpin Co., Colorado	J. Samuels, 40 B'way	500,000			
Downieville	Colorado		2,500,000	25 00		
Eagle Gold	Gold Dirt Dist., Col	J. P. Davies, 19 Cliff	300,000	1 00		
Empire Gold and Silver	BodicBluff,MonoCo.Cal	H. K. Gates, 70 B'way	1,000,000			
Edgehill		A. Fullerton, 71 B'way	10,000,000			
Esperanza Silver		Ezra Clark, Jr., 13 William	400,000			
Fisk Gold		H. Johnson, 195 Fulton	500,000			
Forest Queen		E. B. Beet, 62 B'way	1,000,000			
Golconda Gold	Sherbrooke, C. E.	H. Adams, 71 Broadway	2,000,000			
Gunnell Gold	Colorado	J. H. Rolston, 80 B'way	1,000,000	50 00		50
Gunnell Central	Colorado	C. B. Bostwick, 16 B'way	3,000,000	10 00		
Gold Rock		R. M. Lockwood, 93 Wall	400,000			
Grass Valley					21	23
International Silver		J. W. Brazier, 26 Pine	600,000			
Hope Gold	Colorado		5,000,000			
Holman			2,000,000	25 00		
Kipp & Buell	Colorado		300,000			
Knickerbocker Gold		J. H. Rolston, 80 B'way	200,000	100 00		
La Crosse Gold	Nevada Dist., Col	P. P. Fullerton, 71 B'way	1,000,000		8	11
Lander Hill T. & S	Nevada	M.L.Catherwood,74 B'way	1,000,000			
Lewis Gold	Georgia		1,000,000			
Liberty Gold						
Manhattan Silver	Nevada	M. L. Ogden	400,000			
Maraposa common	California	Jas. H. Ferdon, 34 Wall	12,000,000		6¼	
Mariposa preferred	California	do. do.			13½	14¼
Montana Gold		G. De Cordova	400,000		4	5
Montana M. L. & M. Co.	Montana	A. M. Hoyt, 22 William	250,000			
Montrose	Clear Creek Co., Cal	W. W. Perkins, 71 B'way	1,000,000			
New York Silver	Nevada	Thos. Sproull, 78 B'way	1,500,000			
New York and Austin	Nevada	E. R. Siccomb, 70 Wall	5?2,000			
New York and Owyhee	Owyhee Co., Idaho		1,000,000			
New York and Eldorado		G. H. Munroe, 10 Wall	2,000,000			
N. Y. & Montana M. & D.	Montana	F. A. Chapman, 20 Nassau	1,250,000			
N. Y. & Silver Peach	Nevada	R. C. Root, 74 B'way	2,000,000			
N. Y. & Utah P. & M		W. H. Mailler, 108 Wall				
Nye						
Ophir Gold	Comstock Lode, Nev.	L. C. Warner, 70 B'way	625,000			
Owyhee Gold		W. H. Smith, 43 Ex. Place	1,700,000			
Pahranagat Central	Nevada	J. E. Smith, 25 Pine	6,000,000			
Quartz Hill Gold		F. Bernard	2,500,000		31	35
Reese River Consol'd	Nevada	W. B. Ogden	6,000,000			
Rocky Mountain	Colorado	S. M. Pond, 70 B'way	500,000	10 00	4	5
Rollins Gold		Thos. Bond, 132 B'way	600,000			
Sensenderfer	Colorado	H. A. Shewill, 19 Broad	1,000,000		1 00	
Silver Bend		F. W. Macy, 20 Nassau	1,500,000			
Silver Mt. Silver		H. A. Moen, 71 B'way	1,000,000			
Silver Peak & R. M	Nevada	W. B. Ogden, 52 Wall	5,000,000			
Smith & Parmelee	Colorado	W. H. Hollister, 6 Broad	2,500,000	20 00	1 25	1 30
Social & Steptoe Con		T. H. O'Connor, 24 Nassau	450,000			
Standard Gold		C. B. Bostwick, 169 B'way	500,000			
Symonds Forks					35	75
Twin River Silver	Nevada	J. F. R. Hadden, 20 Nassau	800,000	100 00		
Texas Gold	Colorado		500,000	10 00		
Union Gold	Colorado	F. A. Potts, 110 B'way	1,200,000			
Wash. Mill & Silver	Nevada	W. W. Perkins, 71 B'way	300,000			
Wauba Yuma	Arizona	J. W. Silsby, 36 Pine	6,000,000			

COAL AND IRON COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
American Coal Co		M. A. Myers, 119 B'way	$1,500,000	$25 00		
Ashburton Coal Co		J. T. Rollins, 41 Pine	2,500,000			
Block House Coal		D. B. Keeler, Jr., 43 Pine	1,000,000			
Brewster Iron		H. Robison, 165 B'way	180,000			
Broad Top Coal & Iron Co	Pennsylvania	B. Love	2,000,000			
Cameron Coal Co		J. A. Simpson, 40 B'way	2,500,000			
Carbon Hill Coal Co		J. Silsby, 36 Pine	1,000,000			
Central Coal		F. P. White, 111 B'way	2,000,000	100 00		
Clifton Iron Co		P. H. Riordan, 34 Pine	1,250,000			
Columbia Iron		E. D. Webb, 77 Cedar	1,000,000			
Consolidation Coal	Maryland	J. S. Mackie, 71 B'way	5,000,000			
Crawford Coal		E. Clapp, Prest, 137 B'way	1,000,000			
Cumberland C. & I. Co		E. Kisean, 90 B'way	5,000,000			31½
Derby Coal Co		W. S. Davison, 11 Broad				
Dover Coal and Iron Co		L. Chase, 88 Wall				
Del. & Hudson Canal Co		R. H Nerderpol, 7 Nassau	15,000,000	100 00	100	
Ebervale Coal		G.L.Stout, Treas.,111 Br'y	500,000			
Fall River Bituminous		D. T. Blauvelt, 43 Pine	1,000,000			
Farrar Coal		C. H. Jones, 43 Pine	250,000			
Fisher Iron Co		M. Ellis, 19 William	100,000			
Hamp're & Balt. Coal		S. M. Pond, 70 B'way	500,000			
Iron Cliffs Co		C. J. Canda, 52 Wall	1,000,000			
Jackson Iron		G. P. Loyd, 119 B'way	300,000			
Kemble Coal & I. Co		R. A. Wight, 26 Ex. Place	300,000			
Keokuk Coal		J. F. Franklin, 112 B'way	100,000			
Lackawanna I. & C	Pennsylvania	E. C. Lynde, 52 Wall	1,200,000			
Lewis Run C. & I. Co		C. A. Sanborn, 80 B'way	750,000			
Lykens Val. Coal Co		F. A. Platt, 13 William	800,000			
McKean Co. Bit. Coal Co		J. H. Rolston, 80 B'way	1,500,000			
Lehigh & Susquehanna		E. W. Cark, Philadelphia, Pa.			1 00	
Mahanoy			400,000	100 00		
McNeal C. & I. Co		C. C. Godwin, 71 B'way	500,000			
Mount Riga Iron		G. M. Newton, 42 Cedar	300,000			
New Boston Coal		C. H. Ogden, 55 B'way	2,000,000			
N. Y. Con. C. & I. Co		A. T. Levine, 16 Wall				
N. Y. & Lehigh Coal		T. Simpson, 111 B'way	150,000			
Pacific Coal Co		G. Wrighton, 34 Wall				
Peekskill Iron Co		W. Murdock, 7 Nassau				
Pennsylvania Coal Co		E. H. Mead, 111 B'way	3,200,000	50 00		
Richmond Iron Co		C. H. Smith, 165 B'way	1,000,000			
Scotia Coal Co		I. N. Soper, 42 B'way	2,500,000			
Spring Mt. Coal		J. Runyon, 111 B'way	1,250,000			
Springfield & D'p Run C.		E. D. Webb, 77 Cedar	600,000			
Stout Coal Co		J. S. Comstock, 111 B'way	500,000			
Susquehanna & Wyoming		E. Potter, 40 B'way	1,000,000			
Tannerdale Coal		I. T. Ludlaw, 71 B'way	250,000			
Wash. Mutual Coal		M. C. Baker, 117 B'way	420,000			
West Point Iron Co		R. C. Brock, 110 B'way	500,000			
Wilkesbarre C. & I. Co		W. H. Tillinghast, 80 Br'y	3,400,000			
Wyoming Val. Coal Co		E. Potter, 40 B'way	1,000,000			

COPPER AND LEAD COMPANIES.	SITUATION OF MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED
Anita Copper	California	J. A. Ferguson, 8 Wall				
Corinth Copper	Corinth, Vermont	S. H. Howard, 191 B'way	$500,000	25 00		
Davidson Copper						
Eagle Harbor Copper	Michigan	W. H. Smith, 43 Ex. Place	500,000	25 00		
Evergreen Bluff Copper	Michigan	F. W. Caper, 44 Ex. Place	500,000	25 00		
Globe Copper		R. K. Rickard, 19 Nassau	200,000			
Grand Portage Copper Co		A. S. Kellogg, 22 Pine	500,000			
Guymard Lead		Samuel Vernor, 38 Pine				
Hilton Copper		W. H. Smith, 43 Ex. Place	500,000			
Hope Copper		J. W. Davis, 19 Nassau	500,000			
Hudson River Copper	New York	T. Clarkson, 22 William	1,500,000			
Indiana Copper Co		J. M. Mills, 25 Nassau	500,000			
Isle Royale Copper	Michigan	F. W. Caper, 44 Ex. Place	1,000,000			
Keweenaw Copper	Michigan	F. W. Caper, 44 Ex. Place	500,000			
Lake Superi'r Silver Lead	Michigan	A. S. Kellogg, 22 Pine	1,000,000			
Omiga Copper	Michigan	S. Cooper, 7 Pine	500,000			
Ridge Copper	Michigan	J. L. Gardiner, Jr., 43 Ex. P.	500,000			
Rockland Copper	Michigan	A. Fullerton, 71 B'way	500,000			
St. Joseph Lead	Michigan	J. W. Jones, 6 Broad st,	1,000,000			
St. Marguret Copper		E. P. Sutton, 43 Pine	250,000			
Schoolcraft Copper		R. Walsh, 22 William	500,000			
Superior Copper	Michigan	A. Fullerton, 71 B'way	500,000			
Union Copper		A. S. Kellogg, 22 Pine	500,000			
Vermont Copper	Vermont	J. C. Ely, 191 B'way	500,000			
Wallkill Lead, asst		S. M. Pond, 70 B'way			03	

MISCELLANEOUS.	SITUATION MINE.	SECRETARY AND PLACE OF BUSINESS.	CAPITAL.	PAR VALUE.	OFF'R'D.	ASKED.
American Zinc Co		W. E. Lawton, 19 Cliff	$1,000,000			
Bigelow Blue Stone Co		H. Bogardus, 14 Pine				
Quicksilver					9½	9¾
Covill B. L. M. & M'f. Co		C. R. Bostwick, 302 Pearl	250,000			
Manhattan Marble		H. K. Gates, 70 B'way	500,000			
N. Jersey Zinc Co	New Jersey	A. H. Farlin, 61 Maiden L'e	1,500,000			

On the Discovery of Springs.

By J. THOULET, Mining Engineer, Wilkesbarre, Pa.

THE science of the discovery of springs has been, from the remotest times, the subject of numerous investigations. Not to speak of the modern ones, which will be treated in another part of the present article, we can quote among the ancients the names of VITRUVIUS (Architectura LVIII., cap. I.), PLINY, the naturalist, (Historia Naturalis LXXXI., cap. XXI., XXII., XXVIII), and especially CASSIODORUS, minister of THEODORIC, King of the Ostrogoths, (LIII., epist. LIII.), as mentioning this subject in their writings. Those authors occupied themselves mainly about ascertaining the exterior characteristics, which lead to suppose that a spring exists near the surface of the ground, in a particular locality. The former, alone, gave an exact theory in relation to the origin of subterranean waters, a theory the more remarkable, as in his time the science of geology, on which modern investigations rely exclusively, was entirely unknown. This is, however, not the first instance where we can discern that the ancients never forgot the practical and eminently useful side of the question, in spite of confused divagations, produced by want of exact knowledge, and ignorance, in scientific researches, of rational methods founded upon a series of experiments or natural facts. It was reserved for the middle ages to bequeath us, among other nonsense, the ridiculous belief which even now darkens the intelligence of some persons. We mean the divining rod, worthy in every respect to be delegated among the mysteries of occult sciences, judiciary astronomy, enchantments, amulets, and all the other practices of witchcraft.

At all times magicians, witches and conjurers provided themselves with the *divina virgula*, undoubtedly in memory of the miraculous rod of MOSES or AARON, and the magic rod of CIRCE or MEDEA, of the profane authors. The instrument of actual *bacillogires*, as they are called, consists in a curved or forked branch of nut, hazel, alder, beech or apple-tree, which they hold between the hands, so as to leave it free to move ; while they walk over the ground, it begins to turn as soon as they come near a spot where water exists. This was associated with another performance of the same tendency: a pendulum, formed by a heavy substance and a flexible thread, performs oscillations when it is held above certain bodies, though the arm is motionless. In 1812 M. CHEVREUL condescended to devote his time to some experiments on this subject, of which he gave an account in a letter to the celebrated French savant, M. AMPÈRE, who is so well known in the natural sciences. It was published in the *Revue des deux Mondes*, in 1833.

CHEVREUL took a pendulum, formed by a hempen thread, to which hung an iron ring ; he then put a metallic lump or a living being under water, and the pendulum began to move as soon as it was held over the spot ; by the interposition of a glass or rosin plate the apparatus stopped. Surprised by the persistence of the phenomenon, CHEVREUL, who was endowed with a spirit not very much inclined to believe in the supernatural origin of the observed facts, rested his arm holding the pendulum, on a support, and immediately he observed that the movement was slackening the nearer the support came to the hand, and that it stopped entirely when the fingers themselves were propped. It was thus proved that the movement proceeded not from any sympathy between the pendulum and the metallic lump, but from the operator himself by a physical, though involuntary effort of the arm muscles. This was, however, a kind of analysis which necessitated the performance of an inverse experiment or synthesis. For that purpose he had his eyes blindfolded, and while he was holding the pendulum an assistant brought, at different times, numerous so called sympathetic or antipathetic bodies near it, but the apparatus remained absolutely still.

The movement of the rod used by the spring discoverers is claimed to be caused by a sympathy between the wood of which it is formed and the water running in the ground. Numerous geologists and learned people have been present during the investigations of *bacillogires*, although their presence is generally but little liked by those operators, who prefer to act before countrymen not very familiar with scientific matters. This attendance has invariably resulted in the formal conclusion that bacillogires are either impostors or ignorants. If the first, they keep the rod motionless, until they come near a marshy place, where the eye alone would instantly discover the presence of a spring, and then by a voluntary impulsion from the person the apparatus is made to move ; in the second case, in consequence of a particular moral state and the desire of the operator to find a spring, the rod moves at any place by a physical effort of the muscles, which may apparently be independent of the will. If a digging is made a spring may possibly be found, but it is easy to see, that, as the spot is determined absolutely at random, the probability of finding nothing is the greatest. In this connection I can give a personal experiment. In Italy I secured, after many difficulties, the services of a celebrated spring discoverer, whom I desired to operate in my presence. After he was closely blindfolded, a precaution considered essential, I conducted him near a small pond, which was never dry, even during the hottest summer ; but the rod remained perfectly motionless. Then I took him to a spot where I intended to sink a shaft for mining purposes ; the rod was still quiet. Finally, after having made some circuits, I conducted the man again to the same place, and this time the instrument bent down violently, giving me the information that a spring was very near the surface of the ground. The shaft was sunk to a depth of fifty feet, but not a drop of water made its appearance. For myself the experiment was perfectly conclusive.

The science of discovering springs is a dependency of geology and geognosy. It is a science of observation, relying upon a series of facts grouped together, from the co-ordination of which laws have been deduced. It is consequently not a mathematical science, like mechanics or hydraulics ; it does not proceed by formula, and its theories are sometimes susceptible of exceptions. Nevertheless, the rules it establishes are certain enough to lead to success in the great majority of cases. Their more or less skillful application depends of course entirely on the experience and judgment of the engineer.

It is not necessary to dwell upon the utility of this science, which is of the greatest importance to the manufacturer, the agriculturist, and the mining engineer. To the latter the water is one of his greatest enemies. Studying the lines which the springs follow beneath the surface, it will frequently be possible for him to avoid them, and thus to save a portion of the large expenses caused by the drainage of subterranean works ; and by his knowledge of geology he will be more able than others to point out the spots best suited for the boring of artesian wells.

The writer intends to give here a brief sketch of the rules of this science, and for this purpose the subject will be divided into four parts. In the first, the origin of springs, their formation, and the lines they follow beneath the ground, will be treated. In the second, the places most favorable to seize the springs, and the means to ascertain *a priori* their depth and their size, will be discussed. In the third, a review of various grounds, noticing the most favorable for the discovery of springs, will be given ; and the conclusion will set forth some general observations on the subject of springs.

PLATO, in his "Phedon," believes that the waters of the seas are swallowed in a vast abyss called Tartarus, situated in the centre of the earth, from which they start to form the rivers, lakes, streams and fountains, and that this movement is perpetually going on. ARISTOTLE thinks, that in the interior of the globe the air is changed into water, which then issues to the exterior. SENECA says that certain parts of the earth are transformed into water ; PLINY, the naturalist, without considering the origin of the springs, thinks that the winds cause them to come to the surface ; VAN HELMONT supposes the interior of the globe formed by an immense amount of water, which supplies all the rivers on the outside ; LYDIAT, an English academician, (1605) and PETER DAVITY, (1637) say that all springs come from the water of the sea, which is purified by straining through the soil. All these opinions, and a great many others emitted by CARDAN, DESCARTES, DUHAMEL, etc., are of course absolutely wrong, and without entering separately into the refutation of every one of them, we shall begin by giving a clear definition of the word "spring."

A spring is simply a subterranean current of water. As a consequence of this definition, it follows that every spring is endowed with a motion and possesses a certain duration, the continuity of which is, however, not absolute, as shown by the fact that some springs dry up during the summer. Neither the size of the current of water nor its form change the name, and it is immaterial whether it runs as a narrow water-spout or as a sheet of considerable width and depth. It must be subterranean, and we can, consequently, not give the name of spring to a mass of water running upon the surface of the ground, but call it, though it arises from one or more springs, "brook," or "river," according to the particular case.

Springs are permanent if their size is always nearly the same ; variable if their flow, without ever stopping entirely, depends on rains and drought ; temporary if they stop at times ; uniform if they produce constantly the same amount of water. But it is doubtful whether the last case will ever be found in nature.

The water of springs proceeds only from the aqueous meteors, as rain, mist, dew, snow, hail, etc.; this fact has been ascertained by direct measurements. In hydrographical basins, considered for this purpose by the study of the size of streams crossing it, the amount of water flowing out during a fixed time, one year for instance, has been determined. On the other side, the surface of the basin being known, the quantity of water falling on it was measured with udometers, and it was thus found that the number expressing the amount of water coming from the atmosphere bears to the one representing the water running the proportion of 100 to 14, 25, 34, and even 45, according to the country. It is easy to conceive that the latitude, the duration of summers and winters, their calorific degrees, and the size of forests, change this relation in different regions. By taking an average we can, however, affirm that about four times more water falls upon every basin than flows from it to the sea during the same space of time. The balance of the water fulfills various offices. One part is employed for the subsistence of the vegetation, another feeds the springs, and a third portion is vaporized by the sun, rises in the atmosphere in order to form clouds, and is transformed, according to the season and by the action of various agents, into rain, snow or hail. It falls afterwards again upon the earth, thus continuing the never interrupted circuit whose wonderful regularity sustains the life of nature.

The water thus arrives upon the ground ; if the rocks are impermeable as clay slates, aggregation rocks, granites, porphyries, gneiss, quartz, it slides along their surface ; but if the rocks are permeable, like micaceous slates, gypsum, or detrital soils, it enters into all pores and cracks and goes constantly downward, following the laws of gravity, until it reaches impermeable strata, which underlie all regions at greater or smaller depth. The particles of water, moving with unequal rapidity, meet with others, join together, form innumerable small veins, and by degrees perceptible streams, which, growing larger as they reach a lower level, constitute finally subterranean currents of water, following the dip of the impermeable rocks, and increasing their volume in proportion to the distance from their origin.

It is easy to draw conclusions in regard to the distribution and the movement of subterranean waters from an examination of the circulation of the currents of water on the surface. A stream is formed by several rivers, each of these by several brooks, and the brooks again by an infinite number of springs.

This theory is far more natural than that which supposes a great many lakes, reservoirs, or subterranean collections of water situated in the interior of the mountains, inasmuch as nobody ever saw such a system. In order to increase the volume of a spring coming out of the ground, long trenches have frequently been dug with the idea that those supposed primitive springs might be reached ; but the higher the work was progressing the less water was found. An engineer will consequently not be very apt to perform such a labor, because he knows that he would thus obtain a result diametrically opposed to the one desired.

The veins formed in the interior of the ground divide themselves absolutely like the rain water on the surface, so that the exterior relief of the soil indicates the lines followed by the subterranean waters. They strain through the detrital soil following the rocky strata, and run from every slope into the bottom of the intermediate valley. It is nearly always in the line of the valley that the springs emerge naturally from the ground, and even where they are not visible they are nevertheless there. This law can be expressed as follows : In every valley, vale, defile and fold is a current of water apparent or concealed.

The subterranean waters follow the same laws as rain water on the surface. When a spring takes birth in a vale having the form of a circle, all the veins produced by the neighboring plateaus and hills converge towards the centre. As the spring runs forward in the valley it receives other emanations from secondary vales, towards the mouths of which it tends invariably. Therefore, when a current of water makes an inflection towards a dry vale, which can be seen without going on the field upon a sufficiently exact map, it is possible that an apparent or concealed spring is present, the size of which is proportional to the surface of the vale.

To every current of water visible on the surface corresponds another concealed current beneath the surface, and this concordance is disturbed only when the strata of the valley dip with a gentle slope under the strata composing the steep hill. In this case the subterranean stream sometimes leaves the apparent valley, runs under the steeper hill, and gushes out in the neighboring vale. So may also works done by the hand of man remove the natural channel of the springs, or impermeable alluvial strata deposited on the rocks may cause the water to follow a line distinct from the synclinal formed by the geological strata.

In order to find the concealed but real valley, it is necessary to examine the inclined planes formed by the hills, or the rock strata, as the subterranean streams mostly follow their intersections. Frequently their way is delineated on the surface by temporary overflows of water.

Polytechnic Club of the American Institute.

Meeting held at the Rooms of the Association, April 21, 1870, Professor S. D. TILLMAN in the Chair.

Mr. ROBERT A. CHEESBOROUGH presented a new plan for elevated railroads for lines in cities. The chief novelty of the invention consists in the mode of applying the power, which is done by means of inclined planes. The plan is briefly this :— A double track is supported by steel ropes from the tops of a series of iron pillars. The tracks are not horizontal, but incline in opposite directions. The elevation of the track above the street is to be twelve feet at the lowest point, in half-mile sections ; the elevation of the highest point about twenty-three feet, giving a fall of ten or eleven feet to the half mile. This descent, it is calculated, is sufficient to give a speed of say fifteen miles per hour. By increasing the grade, the speed may be made as great as is desired. Air, or hydraulic lifts at the bottom of the inclines, are used to raise the car to the top of the next incline. By this means, gravity is used as a propelling power, and a single engine and boiler will be able to do all the work. The cost per mile is estimated at $45,000. The inventor thinks that the road can be operated so cheaply as to carry passengers for one cent per mile. Several objections to the plan were then brought forward by members of the institute, all of which were found to have been already overcome by the inventor.

Dr. VAN DER WEYDE then gave a very graphic account of the railroad from Honesdale to Carbondale, Pa., with method of working, etc., to which he added some account of other railroads worked by means of inclines. On some of these roads a speed of twenty-five miles per hour is obtained, and that too with brakes constantly applied, to prevent the train from running away. The grade of this new track is to be cycloidal, in order to give the line of most rapid descent.

Mr. ROOT remarked that a twelve horse-power engine at the end of an incline would lift the car, at its estimated weight of some eight or ten thousand pounds, forty feet high every minute if necessary, and that too after deducting all friction. It is a tremendous saving. It was then stated that in the country the road could be built for $10,000 per mile, as the whole of the road would not be of necessity elevated, the lower ends of the incline of course being upon the ground. The mode of furnishing power was discussed, and the relative merits of compressed air, steam, and the hydraulic methods compared.

Professor TILLMAN remarked that the first railroad in this country employed inclined planes for running the trains. They were abandoned for more economical methods. The cars in those cases had been raised to the summits of the inclines by means of ropes.

Mr. FISHER remarked that the only trouble was in the details. He did not consider ten feet a sufficient elevation for a half-mile run, at least not sufficient to give an average speed of fifteen miles per hour. He thought there was some difficulty in connection with insufficient fall that had delayed the opening of the new tunnel under the Thames, in London.

Mr. D. W. BRADLEY then read a paper upon "Ancient Horology," which was of great interest, and both amusing and instructive.

THE ENGINEERING AND MINING JOURNAL.

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ROSSITER W. RAYMOND, Ph. D., Editor,

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P. O. Box, 5969. NEW YORK CITY.

The International Coinage Question.

THE recent speech of Hon. WILLIAM D. KELLEY, in the House of Representatives, reviews this interesting and important question, the hasty settlement of which was urged by Mr. RUGGLES, in 1867, but fortunately prevented by the opposition of more cautious and better-informed men. Mr. RUGGLES was the Commissioner of the United States at a monetary conference, held in Paris, and seems to have misunderstood the nature, both of that body, and of his functions in it. It is now certain that neither Germany nor England would under any circumstances have joined in the surrender to France of their national systems, which our commissioner was so eager to promise in advance for this country. Sober second thought has possibly changed somewhat his early enthusiasm; certainly it has convinced many who were at first blush captivated with his scheme, that it is unwise and unsatisfactory, neither proposing to secure all that is needed in the way of international coinage, nor likely to secure in reality all that it does propose.

Our readers will find in former volumes of this journal full discussions of the RUGGLES proposition, now virtually obsolete. We shall not renew that branch of the subject, except so far as may be necessary to show the merits of the American metrical system, as proposed by M. KELLEY, who occupies on this subject the same position so ably defended by Mr. E. B. ELLIOTT, of the Treasury Department.

The history of the Paris conference and the record of its sittings show pretty clearly that it was simply an attempt on the part of France to extend her own coinage-system outside of the limits of the Latin league of nations now employing it. But the attempt has resulted in attracting to the French system a critical attention which it was not able to bear; and it now stands condemned before the world, for the following defects:

1. It still recognizes the false notion of a double standard of value; and in fact the gold franc-coins, to which we are asked to assimilate our own, have only been maintained at their present weight by the desperate expedient of debasing the silver coins, in the vain attempt to make both gold and silver legal tender for all amounts, in defiance of the laws of trade. Had France increased the weight of her gold coins, (after the discovery of California and Australia) instead of reducing the fineness of her silver, the discrepancy which we are now asked to remove by sacrificing our better system, would not exist. In that case France would now be in harmony with us, and her blunder of a double standard is the cause of the difference.

2. The weights of the French gold coins are not expressible in exact and simple ratios according to any system. In the metrical nomenclature, the new twenty-five franc piece proposed by France as an international unit would weigh 8.064516 grammes.

3. The coins actually produced by the Mint of France are shown by careful assays at the Mint of the United States to be invariably short in the amount of fine gold required by the French law, the average fineness of the coins being 899.2 instead of 900. This error is always made in favor of the mint, and the profit from it in 1863, on a coinage of 210,000,000 francs, was 164,380 francs, according to the "*compte-generale des administration des finances.*" The difference between France and other nations in this respect is shown by the fact that while the French mint falls below its normal standard by about one one-thousandth, the deviation in England is only one two-millionth, and in Prussia about one one-millionth. Baron NOTHOMB, in his essay on the subject, says truly, "There are no legal napoleons of full weight in existence." The French gold coinage, then, is quite out of the question as a standard for anybody, even in France. It must be re-coined before it can be called honest.

This disposes of one troublesome part of the subject, and leaves us free to inquire, what basis of international unity would be most feasible, most universally beneficial, and most in harmony with simple ratios of weight and value, and convenience of domestic use. We do not wish to have international agreement upon a bad plan. As we have often said in the columns of the ENGINEERING AND MINING JOURNAL, to secure the practical benefits of international coinage, only the following things are necessary:

1. Uniform fineness of gold coins, honestly maintained by the mints of the different nations, and attested by annual international assays.

4. The weight of gold coins stamped on their face, in terms of a cosmopolitan nomenclature, or, in other words, simple metrical weights of coins, and these indicated on the coins in grammes.

3. International treaties, making these gold coins legal tender in all the contracting nations in the full ratio of their weight.

These are the fundamental conditions, and might be adopted by all nations without inconvenience. We think they would bring about, without further negotiation, a gradual assimilation of the coins themselves, or else they would lead to the use of "grammes of money," meaning grammes of standard gold, instead of the local coin names. For moneys of account, at all events, an entirely new unit, the gramme of money, might coexist without disturbance among all the national units.

But some nations—especially England—and a good many private political economists, do not adopt the almost universal ratio of nine to one between fine gold and alloy in coinage. The English fineness is eleven-twelfths; and some continental theorists even demand pure gold for coins. Scientific evidence is divided; but on the one hand, from the too great softness and liability to mechanical abrasion of the fine gold; and, on the other hand, from the too great baseness and liability to corrosion of the copper of the nine-tenths fineness. This question we would not discuss at present. There is no doubt that the alloy nine-tenths fine wears very well. Our gold coins have never been complained of in this respect; and the simplicity and convenience of the relation is a great argument in its favor. Should other nations refuse to adopt, however, a fineness which we do not wish to surrender, what is to be done? In that case the amount of pure gold in a coin must be taken as the measure of its value, and should be printed upon it. But we could not consent to an assimilation based on this feature only. The true end to be aimed at is, undoubtedly, a uniform fineness and commensurable weight or common unit of coinage. We hope England may yield, as there are some signs that she will, if some really simple and scientific system is offered her. But meanwhile it is highly fortunate that the values proposed for the American metrical coinage bear simple relations to the weight of fine gold, as well as to the gross weight of the coins.

Mr. KELLEY's bill provides that each dollar of denominational value shall contain 1.5 grammes of fine gold, and that the coins shall be nine-tenths fine. The weight of the dollar would then be one and two-third grammes. Three dollars would contain five grammes of standard gold, two dollars would contain three grammes of fine gold. These simple relations reconcile the opposing schools, and make it possible for the United States, while adopting the units and the values most convenient to herself, to preserve at the same time harmony with other civilized nations.

This system requires the change of one dollar as follows:

	Weight of fine gold. grm.		Weight of coin. grm.
Present	1.50463	..	1.671813
Proposed	1.5	..	1.666666
Decrease	0.00463	..	.005146

The decrease is only about one-third of one per cent. Twenty dollars would weigh thirty-three and one-third grms., and correspond nearly to one hundred francs, the latter now weighing 32.25806 grms. standard gold. The following table shows the commensurability of various national units by comparatively slight changes, and points out the road in which America will henceforth lead, not follow. And this leadership, let us add, will be founded upon the inherent superiority of the American monetary system, not, as has been the short-lived triumph of the French idea, upon bare audacity and restless propagandism.

METRIC DECIMAL BASIS.

	Fine gold. grammes.	Weight of coins. grammes.	
Three Union Crowns of Germany	30.	33⅓	
(Present) 20 dollars, U. S.	30.0926	33.4362	9/10 fine.
" 100 Francs	29.032258	32.25806	
" 1,000 pence sterling	30.5100	33.2800	11/12 fine.
" 4 pounds sterling	29.2895	31.9522	

It may easily be seen from this table how slight are the changes required to bring these numbers into unison. In the case of the English coinage, the change required, if 1,000 pence are taken as the equivalent of twenty dollars, is smaller than if the attempt is made to conform the sovereign to the value of our new half-eagle. A coin containing say two hundred and fifty pence, or, say a metrical pound (which would be between a pound sterling and a guinea) would weigh at present 8.32 grammes of English standard gold, whereas it should weigh 8.33⅓ of American standard gold, *i.e.*, of gold nine-tenths fine.

M. ELLIOT, in a recent *brochure* upon the subject, arguing the matter on the basis of the contents in fine gold, justly remarks that "the chief point of practical moment soon to be decided by commercial nations is, whether 30 or 29.032258+ grammes of fine gold—the former the German standard, the latter the French standard, shall represent or define their value." This German standard is represented by the new German crown, of which nearly $7,000,000 worth have already been struck.

We do not believe that Congress can be deceived in this matter as to the demands of science, trade, or national advantage. For the sake of the enlightenment of the whole public, however, we should be glad to see the matter referred to a competent commission, including men of science, officers of the mint, and merchants and travelled men. If they furnished a volume as valuable and interesting as the report of the recent British Commission on the same subject, their appointment would be amply justified.

The Lake Superior Iron District.

M. A. P. SWINEFORD, editor of the Marquette *Mining Journal*, has compiled a neat little volume under the above title, comprising the history of the mines and furnaces in that region, and presenting one of those pictures of amazing industrial progress which would be astounding in any other country but the United States. Here, it scarcely excites remark; but even in this progressive nation, a recital of the facts can scarcely fail to awaken surprise and national pride.

The discovery of iron ore at Lake Superior, in 1845, was received with incredulity; and even after all doubt as to its abundance and good quality had ceased, the practical difficulties in the way of its development were such as to discourage all except the boldest and most far-sighted men. As Mr. SWINEFORD remarks, the iron hills lie in an unbroken forest, fourteen miles from the lake, and means for transportation to the lake-shore must be provided. Communication between the Lake Superior country and the cities on the lower lakes was precarious and very expensive. To get the ore to market, it must be shipped at high rates on the few small vessels that had been brought to Lake Superior over the portage. At the foot of the lake, the ore was discharged, hauled over the portage and around Sault St. Marie, and again loaded in vessels for ports below. This was a tedious and expensive process, greatly increasing the commercial risks of the mining business. It was also necessary for the new ore to fight its way into the favor of the iron workers. It seems strange to us now, that the surpassing excellence of the Lake Superior hematite should ever have been questioned. Indeed, this question was speedily answered by convincing practical tests, proving its tenacity to exceed that of the Swedish, English and Russian iron, while its freedom from sulphur, phosphorus and arsenic entitled it at once to the highest rank, and at the present day renders it the best material for the new processes for the rapid and cheap manufacture of cast steel. The railroad to the mines, the docks at Marquette, (where nature has ungraciously refused a harbor,) and, above all, the ship-canal around the Falls of St. Mary, occupied in the different stages of agitation, negotiation and construction, the first few years. The canal was completed in 1855, and from this time dates the active development of the Lake Superior iron interest. This is a case in which figures speak louder than words; and the following comparative statement of production must be accepted as positively vociferous!

Year.	Iron Ore. Tons.	Pig Iron. Tons.	Total Tons.	Value.
1856	7,0 0	—	7,000	$28,000
1857	21,000	—	21,000	60,000
1858	31,035	1,629	32,664	249,202
1859	65,679	7,258	72,937	575,529
1860	116 908	5,660	122,658	736,496
1861	45,430	7,970	53,400	419,501
1862	115,721	8,590	124,311	984,977
1863	185,257	9 813	195,070	1,416,935
1864	235,123	13,832	248,955	1,867,215
1865	196,256	12,283	207,539	1,590,430
1866	296,972	18,437	315,309	2,405,960
1867	468,076	30,911	496,987	3,475,820
1868	507,813	38,246	546,059	3,992,413
1869	633,238	39,003	672,241	4,968,435
Total in fourteen years,	2,915,468	394,162	3,119,630	$22,769,713

This, it must be remembered, is not the record of a mere speculative excitement. This steady progress, interrupted only by the years 1861 and 1865, marking the beginning and the end of the rebellion, has been achieved, in spite of the fluctuations of currency, business and speculation; and in the year 1869, when many industries throughout the country were almost at a standstill, the Lake Superior companies are understood to have divided among their stockholders not less than two million dollars, or forty per cent. on the value of the products shipped. They now supply the ore from which is made one-fifth of all the iron manufactured in the United States. The work to which we have alluded contains descriptions of every mine and of the fifteen blast furnaces now in the district, and in the appendix is the interesting article by Major T. B. BROOKS, of Negaunee, on the geology of the Marquette orebeds, and the system of working them. This we shall endeavor to present in our columns, if space permits, and for abundant and valuable information on other points connected with this region and its thriving industry, we refer our readers to Mr. SWINEFORD's book, of which the first edition is by this time exhausted, but a second is in press, copies of which will be mailed by the author from Marquette, postage prepaid, on receipt of the moderate sum of one dollar.

Answers to Correspondents.

G. S. S.—The best means of cleaning rusted batteries and pans is to run them on poor quartz until they become bright. Copperplates must be well cleaned before rubbing on the quicksilver, in order to expose the metallic surface.

SUBSCRIBER.—In reply to your communication, we would say that the Chalmers-Spence composition was the first non-conductor covering for boilers introduced in this country from Europe, where it has been in operation for some six years. It is in successful use here by some of our largest sugar refiners, steamboat and railway companies (Hudson River and Erie), and has the advantage over felt of durability, neatness, and non-conducting qualities. We believe it is sold by the ton, with directions for applying.

MINING SUMMARY.

CONTINUED FROM PAGE 261.

joining it on the west, having afterward been organized. In this district, the principal placer diggings are found, there being here also some promising veins of quartz.

A town called Julian City has been laid out in the district of that name, which now contains several cabins and a score of tents, a large share of the population consisting of some two or three hundred, sleeping out of doors. There are about a thousand people in the country altogether, and as most of them are engaged in prospecting, the population is widely scattered.

The country rock here is a talcose slate, through which the quartz veins run in a southeast and northwest direction. They range from nine inches to three feet in thickness, and appear to spread with depth attained, though none have been opened to a greater depth than fifteen or twenty feet. The gangue is composed of quartz and felspar, and carries only free gold, without either sulphurets or base metals. Several of the ledges exhibit traces, and a few quite a notable per centage of silver, and it is thought by many that this metal will increase, and perhaps largely preponderate, in the most of these lodes, when developed to considerable depths. Several parallel ledges, separated by small distances, have been found here, all traceable for a mile or more.

The principal claims, so far as proven, are the George Washington, the Lincoln, Hayden, Hamill, Van Wort, War Path, and High Peak. From the first of these the most valuable specimens of ore have been taken, though each of the others, as well as some claims not included in this list, have yielded considerable quantities of rich rock. Some samples sent to San Francisco, and weighing in all several hundred pounds, will yield at the rate of ten or twelve thousand dollars per ton. So far as opened these lodes continue to carry good ore, though not in all cases so rich as that found on the surface; and it is generally thought the gold will be found collected in spots or pockets, and not generally diffused throughout the mass of vein matter. But even if this should prove to be the case these mines must yield enormous profits to the owners, and, as a whole, cannot fail to prove of great advantage to the region of country in which they are situated, and more especially the town of San Diego, with which they are to be connected by a first-class wagon road, now in course of construction.

The placers here will, it is believed, prove of but little consequence, the country showing no extensive wash or deposits of gravel. The only pay dirt is found below the rich spots in the quartz lodes, from which the dust has been released by decomposition, and afterwards washed down by the rains. Miners owning the best claims are unable to make more than two or three dollars per day at washing, the average earnings of Chinamen being scarcely more than one dollar per day.

What will be likely to deter men from going to these mines, with a view to obtaining permanent interests, is the fact that the discoverers have already located the land covering the best portion of them; there being also a danger that a Mexican grant, known as the "Quillamack" claim, covers, or will be floated over them. The validity of these claims may fail to be established in the end, but should they be insisted upon, they would undoubtedly give rise to much vexatious and costly litigation.

Rumors of other and less pretentious discoveries have meantime been rife; nearly all parts of the coast coming in for a share of these new openings to enterprise and newly-found fields of wealth. Nor have these reports always been without foundation, some very important mineral discoveries having been made, and the rumored richness of others confirmed during the last few months. At Pine Grove, Silver Peak, Humboldt, about Austin, in the Cortez, and several other of the earlier settled districts of Nevada, mining operations are being attended with signal success. In White Pine, while the results obtained throughout the winter scarcely met the popular expectation, the prospects for the future may justly be pronounced most excellent. It is, however, now pretty well established that there are in that section of the State better mining localities than White Pine, foremost among which stand the Eureka, Cope, Secret Spring, Bull Run, and Ely or Meadow Valley districts.

In our own State, vein-mining is rapidly increasing in favor, and it is hardly too much to expect a general revival of this interest here the coming summer. Many claims that had, for a time, suffered a falling off are again increasing their yield, while work long suspended has been resumed upon others with satisfactory results, and even mines that formerly could not be made to pay are, under present more favorable conditions, being operated with profit. As an example in point, we have the mines on the Fremont estate, which, having for years been worked only with loss to the owners, are now yielding a net profit of more than a thousand dollars a day, the cost of milling the ores having been reduced to $1 per ton. The Allison ranch claim, after being forced, through bad management, and a falling off in its ore supply, to suspend operations for several years, is now yielding large returns. So, too, with the equally famous Soulsby gold-bearing quartz mine, in Tuolumne county, which, after producing for several years with an affluence that rendered it one of the historic mines of the State, lately suffered, through temporary causes, considerable contraction of its yield. Except, however, in encountering those slight vicissitudes incident to every masterly vein, the productive capacities of this mine are really not at all impaired or diminished; and there is no question but it will be early restored to the list of our foremost and largely productive mines, the recent relaxation of operations upon it being chiefly due to the impaired health of the principal owner, and not to any scarcity or marked impoverishment of its ores. The Soulsby is still justly regarded as one of the most valuable properties of the kind in California, having capacity to yield largely under an energetic management, and presenting unmistakable features of permanency. The ores of this mine carry a notable percentage of gold-bearing sulphurets and galena, one of the recognized indications of a strong and permanent lode. Having heretofore turned out over a million and a half of dollars, it will probably yield with equal generosity whenever its productive energies shall be taxed as before. Cases of this kind might be indefinitely multiplied, all tending to establish the permanent character of this class of mines, and the necessity for well-directed and persistent effort in prosecuting the work of their development.

From more remote localities, as well as from those within the limits of our own State, flattering accounts continue to reach us concerning operations in this class of mines. In Arizona several mills are now running steadily and producing considerable amounts of gold bullion, the Vulture company's forty-stamp mill having, for a long time, been engaged on high-grade ore. In Southern Idaho, one of the best vein-mining regions on the coast, the prospects of this interest are extremely bright, many of the lodes yielding beyond all expectation, and much eastern capital being about to embark in operations there. Quite recently, the Monarch company's mine, situate on the Atlanta lode, which holds the same position in Idaho that the Comstock vein does in Nevada, has passed into hands which will be likely to insure for it a more extended and vigorous development, which alone is required to place it in the forward rank of our largely productive and remunerative mines. In Montana, also, many mills heretofore idle are about to start up, with every prospect that they will hereafter be kept steadily and profitably employed.

THE PLACER MINES,

on all parts of the coast, are likely to yield their accustomed revenues, the apprehended scarcity of water having been averted by the late copious rains. From these there is an ample present supply, which the accumulated store of snow upon the mountains will prolong beyond what there was reason to expect early in the season. As a consequence, the earnings of this class of miners will probably reach an average the present year. The accounts from the diggings on Loon Creek, Idaho Territory, as well as from Cedar Creek, Montana, are moderately favorable, and quite an emigration is setting toward those localities.

INCREASED FACILITIES FOR TESTING AND DISPOSING OF ORES.

A great trouble in determining the probable value of mines, whether the object be to buy, sell, or work the same, has heretofore been the difficulty of testing the ores in a practical way without too great a cost. In the absence of facilities for making these trials cheaply and readily, the miner has often been induced to part with valuable properties for an insufficient consideration, while the purchaser has, for the same reason, frequently paid for them far more than they were really worth, causing this class of transactions to be attended with too much uncertainty for the good of either party. The assaying of a few picked samples of ore, as heretofore practiced, has afforded no safe criterion of the general contents of a lode. What has been required is a working test of average ore, or the crushing of more considerable quantities, to be sold by sampling the pulp. Fortunately, the construction of the railroad, by cheapening freights and the establishment of suitable metallurgical works in San Francisco, have enabled parties to procure all needed trials of ores to be made speedily, and at very little cost. Ores carrying even a moderate percentage of the precious metals can now be shipped to this city from almost any part of California, or the State of Nevada, with a chance of some margin for profit, whether worked here on the owner's account or crushed on pulp assay, to the highest bidder. There are now here a number of establishments engaged in the sampling and testing of ores, with a view to their being disposed of in this manner. There are also houses who make advances on the ore as soon as its value can be ascertained, thereby enabling the miner to realize at once on his shipment to the extent of half or more of its value—the balance to be paid, less actual expenses and a commission of five per cent., after its final sale in Liverpool, where it is sent for a market. Besides these there are several other places in the city where parties can have quantities of ore worked, with a view to determining the average character of that contained in their mine, as well as lots of extremely rich ore reduced, in the management of which extreme skill and care are required, and where the well known integrity of the metallurgist will afford a guaranty of fair dealing. The works of Morris & White, 30 Fremont street, where this branch has been made a specialty, and where the utmost satisfaction has always been afforded, have lately had their capacity extended, and these parties are now able to reduce any quantity of high-grade ores that may offer, with their accustomed closeness. The extensive smelting establishment of Thomas H. Selby, in this city, is also about to undergo enlargement, the already considerable and immense prospective increase of ores requiring reduction by this method calling for additional facilities for their treatment. Miners having ores suitable for smelting can now consign them to Mr. Selby, who will defray all freight charges, and pay them for the same, according to a fixed scale of prices, which admits of a handsome margin for profits to the miner on all fair grade ores. Under this arrangement the miner incurs no expense, except that attending the extraction of the ores, and is certain of getting a fair price for them, according to their actual value.

Apprehensive that the more refractory class of argentiferous ores could not be reduced here economically and effectively, considerable lots have been shipped during the past year from eastern Nevada to the Atlantic States and Europe for treatment. The shippers, however, having recently become aware of the fact that the most obstinate ores can be managed here as well as in any other part of the world, are now sending them this way, thereby realizing equally as close working, quicker returns, and saving largely in the cost of freights, insurance, and other incidental expenses. Car-loads of ore are now arriving daily from that quarter, and there is no doubt but these shipments will rapidly increase, and that this will become in a short time an immense traffic, profitable alike to the miner, the metallurgist, and the railroad company.

THE STATE GEOLOGICAL SURVEY.

The passage of a law by the Legislature, at its recent session, making provision for the continuance of this important work will, it is expected, insure its early resumption under the supervision of its able director, Prof. Whitney. The prosecution of this work being so clearly in accordance with a wise economy, this measure accords with the popular desire, as promising not only to greatly benefit both industry and science, but save our State the reproach that must have attached to the abandonment of a work so useful and beneficent.

Arizona.

The Prescott *Miner* has the following summary of mining news:

"BIG BUG DISTRICT.—The news from this district is first-rate. A clean-up was made, one day last week, and a bar of gold worth $1,800 realized. This was the result of ten days' work with ten stamps. It is said that not many months will elapse before at least as many more stamps will be set up and running. Men are at work on the mine in three different places, and there is plenty of good ore in sight.

"WALKER DISTRICT.—Jackson & Co. think they will be able to start the Eureka ten-stamp mill, to-day. Mr. Tiernan, their millman, started from town for the mill, early the present week. The first rock crushed, after testing the machinery, will be from the Box Elder lode. D. J. Marr and others started for the district, Wednesday last, with provisions and tools. They are going to work the Accidental, one of the richest gold lodes in the country.

"WEAVER DISTRICT.—An old pioneer of Antelope Hill is running an arastra there, and many Mexicans are at work in the placers. A very rich gold-bearing quartz lode was recently found between Peeples' Valley and Date creek. The people down there are said to be in a high old state of excitement about it. Charley Genung, Pete Smith, Fred Henry and others have taken up ranches and water-privileges in the valley, in which, by the way, there are 2,000 acres of good land, and abundance of water and timber. They have rich mining claims in Walnut Grove mining district, and Fred Henry, who called on us last week, said it was their intention to build water-wheels and arastras in the valley, and there work their ores. Henry has a lode named the Malta, which is exceedingly rich in free gold.

"WALNUT GROVE.—Mr. S. C. Rogers, who came up from the Grove a few days ago, reports that Allan Cullumber had struck good pay-dirt in a large bar above his dwelling-house. He was washing away when Mr. R. left. Col. Cany, Mr. Meyer and another professional miner started Wednesday last, to look at some mines in Walker and Hassayampa Districts. Should Mr. Meyer and his friend see anything to please them, cash and a mill will be likely to come here from San Francisco.

"WICKENBURG DISTRICT.—At latest dates from Vulture City, the Vulture Mining company's 40-stamp mill was crushing away. The company talk of erecting a small mill and works to operate upon the sulphurets. Work was being pushed on the tunnel of the White Picacho mine. We are without news from the placers, this week, none of the miners having come to town."

California.

A correspondent of the San Francisco *Morning Call* thus writes from San Diego, March 24, professing to give the truth about the gold mines. He says: "Various untrue and exaggerated reports have lately reached San Francisco in relation to the mines in this vicinity, which, with your permission, I will endeavor to correct, and give your readers a trustworthy statement of the condition of things. The large specimens forwarded from here to your city are choice pieces, selected from the so-called Washington ledge, in the Julian district. This lode is about eighteen inches in thickness, and no other so rich has been found here, though specks of gold have been discovered here and there. There are some six other ledges in the same hill, which have quartz of similar appearance, though no gold is visible. After burning and pulverizing the lumps, however, gold is found in them. I do not doubt that some rich deposits will be found in that region, though it is well known that gold-bearing ledges only pay in spots.

"WANT OF CONCERT OF ACTION

"There is no system among the miners, and much money is wasted in irregular prospecting. A single tunnel would test all the ledges in that mountain, and outside of that belt there is no indication of gold, though there are many other granite quartz ledges, which contain hornblende and isinglass, northward toward Vulcan creek. The mountain is steep, and tunnels might be started from the north and south sides, with sufficient fall for drainage, to meet in the centre, which would save pumping and the cost of an air shaft, and the companies could work their ledges from the same drift, still doing their business separately. I saw no indication of silver ore, but think some may be discovered on the edge of the desert, where the mountains have more the appearance of the Washoe mines.

"TOPOGRAPHICAL CHARACTERISTICS.

"There is splendid water in all the cañons, the grass grows to the top of the mountains, which are also covered with groves of live oak, burr oak, and pine. Spruce and hemlock are also found a few miles to the north and south. The valleys are moist, and should produce luxuriant crops. Some of the farmers are just planting and sowing. I saw cornstalks on the Vulcan which measured about two inches thick, and some stood without the tassel, eighteen feet high.

"THE DIGGINGS.

"The surface diggings will not pay, for there is no regular wash or gravel. The quartz and pieces of slate rock are angular, which proves that they have been broken from the ledges above; and I found another evidence by panning, viz.: the dirt from the pay-rock showed scarcely a color, while the top dirt had from ten to twelve specks of fine gold. There is much black sand (though some of it is granite) and specks of iron. Some think they will make it pay better on the bed-rock, and have dug a drain; but I am satisfied they cannot make "grub." Some of the boys had been to Dry Lake, and could get three cents to the pan, and others talked of going to San Felippe, where it is said the Indians get coarse gold, but do not like the whites to come there.

"A TOWN

Has been laid out, and lots were selling at $20 and $25, about a week ago, but I am told they are now up to $100.

"GENERAL CONCLUSIONS.

"If any of my Washoe or San Francisco friends want to see for themselves, let them come, but not expect too much. Gold is there, but it don't lie everywhere on top, as it happened in that one spot, but time and work will bring it forth. The ground will be easily worked, for the granite and slate-rock are partly rotten, and the quartz is full of seams. The ledges are narrow on top, but seem to increase gradually in width going down. Their course is about east and west, or southeast and northwest. Be sure and have plenty of warm clothing, and at least two pairs of blankets and a tent, until you can build a cabin. Logs can be had quite handy. I did not think San Diego county had such good farm land as I saw on the way to the mines, but it lies waste, for the simple reason that it is cursed with a Spanish grant. I hope our assessor will do his duty. So far they have had a good thing of it, but taxation will make them sell."

Colorado.

SALE OF THE TERRIBLE MINE TO ENGLISH CAPITALISTS.

The Georgetown *Miner*, March 31, announces with great glee the sale of one-half of the Terrible mine for a very large sum to British capitalists. It says: "We seize with strange alacrity the opportunity afforded us for giving publicity to a statement of stupendous magnitude. One-half of the justly celebrated Terrible, the largest and richest silver vein in Colorado, has been purchased by a company of English mining capitalists, for a sum of money sufficiently large, if used for that purpose, to liquidate the interest on the national debt—estimating it at two thousand five hundred millions—for one day! This information comes from Mr. Henry Crow, former part owner of the recently purchased interest, who is in receipt of a telegram from his partner, Mr. Fred. A. Clark, now absent in England, and through whose negotiations the sale was effected. An agent of the English company will be sent hither immediately to take charge of the mine. Until the date of his arrival, the workings of the mine will remain under the supervision of Mr. Crow. At this time the Terrible is producing a quality of ore such as will make glad the hearts of the foreign capitalists. We offer our highest congratulations to Messrs. Clark & Crow, in view of their recently acquired independence."

BUSINESS AND PERSONAL.

[*Short notices in this column fifty cents per line each insertion.*]

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April 19, tf.

The Canals of England.

In an article on the canals of England, published in the *Railroad Gazette*, we find the following interesting information. They are divided into two classes, those intended to connect great tidal rivers, arms of the sea, etc., so as to save time and shorten distances, and those designed for general purposes of transportation between the interior of the country and the sea. In England the last of these classes is much the larger of the two and forms a complete network of inland navigation, there being no point on the island distant more than fifteen miles from a navigable water-course. The canals of England are generally quite small, the locks capable of passing boats of but seven or eight feet in width, and sixty-five or seventy feet in length. These little vessels, however, make up by their number and the frequency of their trips what they lack in capacity, so that the quantity of freight which is borne by them is prodigious, considerably exceeding in most cases that which is carried by their rivals, the railways. This is due to the superior cheapness of transportation by water, at low speeds, of those articles which weigh the most, compared with their intrinsic value, and which therefore cannot bear any but low rates of charge—such as coal, crude iron, minerals of all kinds, and some agricultural products. Before the general introduction of railways into England, the profits of canals were very large, indeed truly enormous, as may be judged from the fact that the aggregate amount of the capital stock of fifteen of the principal canals had, in 1822, risen to more than 7½ times the price at which it was subscribed (the increase in one case being 17, and in another 35 times ;) and no wonder, as the dividends in that year averaged 32 per cent. of the par value. The interest in the public mind in regard to railways was just then beginning to manifest itself, and although the actual competition with this new mode of transport did not come on till a number of years later, its forecast shadow so overclouded the future of canals as investments of capital that in 1828 the market price of the shares just mentioned had fallen 20 per cent., or to but six times what they had originally cost, although the dividends had actually risen to 36 per cent. upon that cost.

Railways for a time, after their complete establishment, produced so great a depression in the value of the canals as in some instances to suggest their abandonment or filling up, and the laying of rails upon their former beds. Notwithstanding this, however, most of the British canals still carry the bulk of the mineral and agricultural, and the heavier manufactured products of the country which do not require speed of transportation ; and the two systems have come to work with a fair degree of harmony when contrasted with the virulence of their former rivalry. Even in the conveyance of passengers upon routes between large cities, the canals, by means of light boats of suitable model, and relays of fleet horses, and, to some extent, by the help of steam power, have been able to attain a speed, which, although not approaching to that of the railway, is fast enough, when combined with low fares, to invite the travel of the class who cannot afford to pay for the luxury of the superior mode of conveyance.

Variable Expansion Gear for Winding Engines.

An important invention, connected with the working of mines, is described in the French coal-trade paper, *La Houille*. It is generally admitted that the application of expansion gear to engines ensures an important economy of fuel, yet hitherto winding engines have been worked without it. The many conditions to be satisfied render it, indeed, difficult to apply, and cause mine owners who use unsaleable debris for the raising of steam to hesitate before adopting it. But special circumstances have now made its application unusually desirable —the want of boiler space consequent upon the daily increasing activity at the pits. Thus, obliged as they would be to buy new boilers, it has been deemed preferable to utilise to a greater degree the steam already at their disposal, by causing it to produce more useful work by using it expansively. This secures not only the advantage of diminished consumption of fuel, but also renders available part of the boilers, the number of which had become insufficient. The question has been most successfully solved by Mr. AUDEMAR, the engineer of the Blanzy mines. After having successively tested and rejected fixed cut-offs, as well as several special arrangements proposed to him, Mr. AUDEMAR hit upon a form which was first tried for six consecutive months upon an engine of 250 horse-power, and then, having succeeded perfectly, to six other engines of similar power, which were previously worked without a cut-off, and which now work with the greatest regularity on the works of the Blanzy Company.

The conditions which experience had proved to be necessary were—to work the machine with the expansion gear, and to be enabled to suppress the action of the cut-off instantaneously, when desired ; to render unnecessary the attention of the engineer, who has already enough to attend to ; not to increase the number of levers he will have to work, nor the power necessary to work them ; and to make the cut-off variable, so as to adapt itself to the variations of resistance of the load to be raised. The apparatus consists of a double cam, one-half of which serves for the forward stroke, and the other half for the back stroke. Each portion of this cam has varied profiles, so as to give the various degrees of expansion, from the smallest to the greatest ; and it is so disposed that the middle becomes the neutral point, like that of the STEPHENSON slide, and corresponds, like it, to no admission, whilst the two extreme points give full open. A valve on the Cornish system, placed before the ordinary distribution of the machine is used to produce the expansion of the steam. This valve is put in motion by the cam, the rotation of which is caused by the gearing on the shaft of the engine, and it opens and closes according as one or other part of the cam is for the time being in operation. If the STEPHENSON slide be at its neutral point, the cam would be in a similar position, and the two being set in motion by the same lever, will at the same time occupy the extremes of their course. If, then, the engineer inclines his reversing lever, the several profiles of the cam being presented to the valve, produce a corresponding cut-off, which will become absolutely none if the lever be pushed full home. Thus, the mere inclination of the lever which the engineer already uses, suffices to produce the desired effect both for the forward and backward movement.

An essential feature is that the objections to the STEPHENSON slide when not at the extremities of its course are avoided. The connection of the slide with the cam is, in fact, made by intermediate sectors, so that the speed of the two parts is widely different. Thus the slide always occupies the end of its course, and gives the maximum opening to the ports, although the cam is sufficiently advanced to produce considerable expansion. The system, which appears to be free from complications, and which has been practically applied, has enabled the Blanzy Company to dispense with the purchase of boilers, which had become indispensable, and to secure in addition a saving of fuel equal in some cases to 40 per cent. And they were enabled in one case of four boilers already over-worked to put one out, for the purpose of cleaning. These results are so remarkable that the general adoption of the invention is confidently anticipated ; and, as all the parts are ready made, the stoppage for a single day is sufficient to apply the arrangements to existing engines ; and they, moreover, meet the approval of the workmen, because they do not at all interfere with their existing habits.—*Min. Jour.*

New Railroads in Turkey.

THE system of Turkish railways which is now about to be commenced, and the funds for which are to be obtained from the Lottery Loan, is a very extensive one, and, like the great work of the Suez Canal, owes its origin to a French engineer. According to the firman which the Sultan has accorded at the instance of his Minister of Public Works to Mr. Talabot, the total *reseau* of Turkish railways will consist, when completed, of a main line from Constantinople to the Save, and of two cross lines, the one traversing the centre of Roumelia, and connecting the Black Sea with the Archipelago ; the other opening to all the agricultural wealth of Hungary, and to the richest districts of European Turkey, a direct communication with the sea at Solonica. The *Daily News* says that the extent of these works will not exceed a tenth of the railway system already constructed in France ; and, considering the area of European Turkey, its fertility of soil, its mineral and forestal wealth, its temperate climate, and its abundant water courses, it can hardly be doubted that the result of the first concessions will be to encourage the extension and completion of the *reseau*. In point of engineering difficulties there is nothing, from one end of these projected lines to the other, comparable to the Mont Cenis or the Semmering Passes, not to speak of the wonders of the Western Hemisphere.—*London Railway News.*

Miscellanea.

THE White Pine Water Works were sold at Sheriff's sale, and were bought by WILLIAM B. BOURNE, of San Francisco, for the sum of $43,000 in United States gold coin. The entire property of the company has been turned over to F. A. BENJAMIN, agent for Mr. BOURNE, and superintendent of the Stanford mill.

A CITIZEN of Buffalo has patented a letter box for street use which possesses many advantages over those now in use. Its arrangement is such as to admit letters or packages of moderate size, and at the same time shut off all possibility of access to the box except by opening the lower receptacle and violating the government lock. The opening into the box forms a table, upon which the letter carrier may take out the mail matter deposited. But this is but a minor advantage as compared with the automatic process by which, if mail matter is deposited by any person, he can see that it is dropped into the final repository, and be sure that it cannot be extracted by any other than the letter gatherer. The process of this is very simple. The cover of the box acts by means of a few simple rods in the interior in such a manner, that when the cover, or lid, is moved to admit mail matter, the aperture of the lower box is closed, and the mail matter is precipitated to the receptacle mentioned. The interior metal box is so arranged that when the top is opened, at no angle can any substance reach the depository. The opening of the lid closes all access to the lower box, and the closing of the lid drops the mail matter into it.

A TELEGRAM from San Francisco says that Col. VON. SCHMIDT has completed the excavation of Blossom Rock, and powder has been placed and wires run preparatory to the explosion, which is fixed to take place next Wednesday. The excavation is one hundred and thirty-two feet in length and sixty feet in width, and its greatest depth is twelve feet. The excavation is filled with twenty-three tons of powder.

AN interesting experiment has just been made in the Union Pacific foundry, Omaha, of manufacturing cast-iron with Wyoming coal. The proportion of metal and coal were nearly in the same ratio as in ordinary operations with Pennsylvania coal. The result showed that the new fuel was of superior excellence, and adequate for all the uses of iron mnnufacture. The iron was improved in grain and toughness, and no sulphurous gases appeared in the whole operation. This success must have an important bearing on the future of the West.

THE business of smelting base metal ores is rapidly increasing at White Pine, several furnaces being now in successful operation upon the ores of the base metal range, lying opposite Treasure Hill on the west. After years of experimenting and repeated failures, smelting has become a success on the Pacific coast as a practical method for the reduction of the rebellious silver ores. This success, says the San Francisco *Commercial Herald*, is the commencement of a new era in silver mining, which will probably double or treble the product of bullion in the State of Nevada within the next two years. When we reflect, continues our contemporary, that there are fully one hundred tons of base metal ores to one ton of free milling ores in the silver region, we can form some idea of the magnitude to which the smelting business may be expected hereafter to attain ; and when it is considered that smelting works capable of reducing twenty tons per day can be built in Eastern Nevada at a cost not exceeding $5,000 or $6,000, while a mill of the same capacity would cost $40,000 or $50,000, the assertion that the bullion product of that State will be as large from smelting as from milling, twelve months hence, seems not at all extravagant.

THE Mount Cenis tunnel will certainly be finished during the present year. On the 1st ult., the galleries opened measured 10,598 metres, and there only remained 1,621 metres to be excavated.

THE ADVERTISERS GAZETTE, issued by G. P. Rowell & Co., No. 40 Park Row, New York, contains much information not to be obtained elsewhere. Every advertiser should read it. Sample copies by mail for 15 cents.

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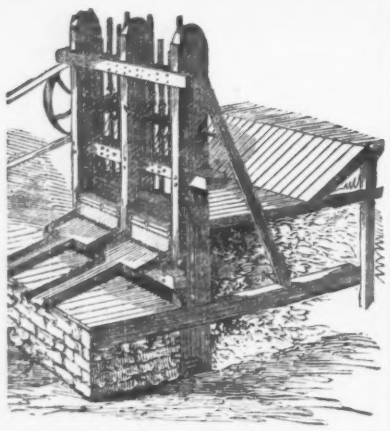

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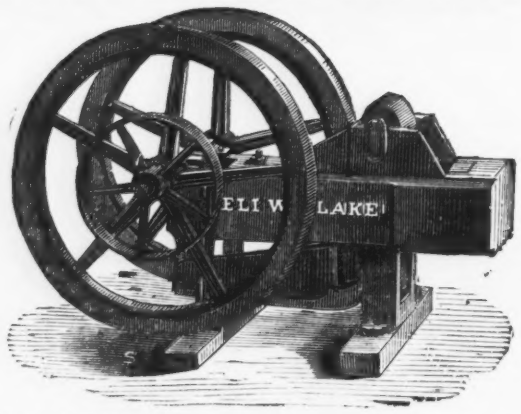

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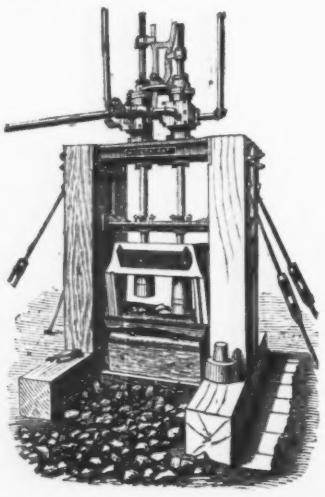

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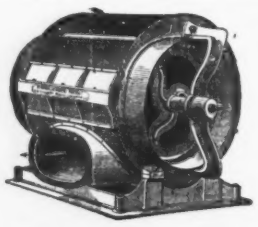

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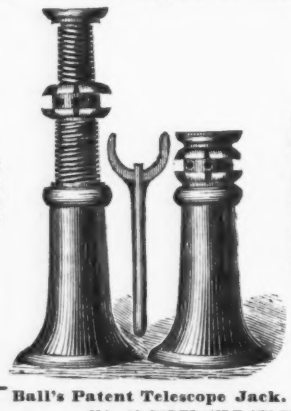

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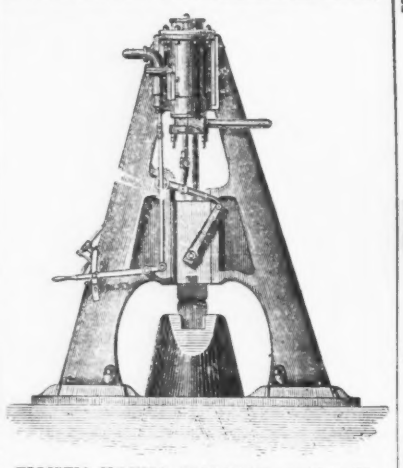

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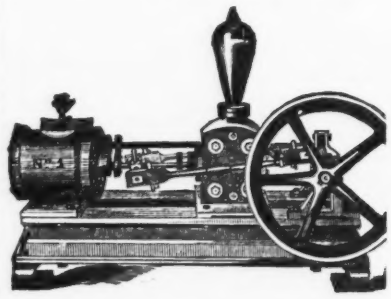

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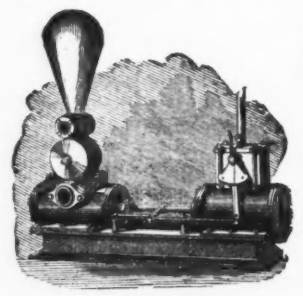

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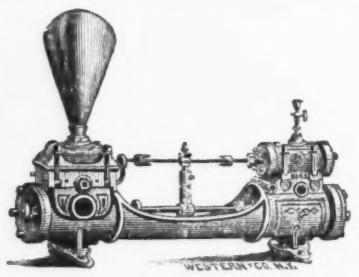

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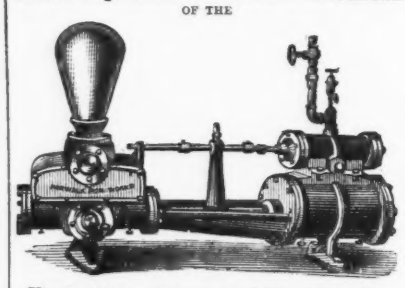

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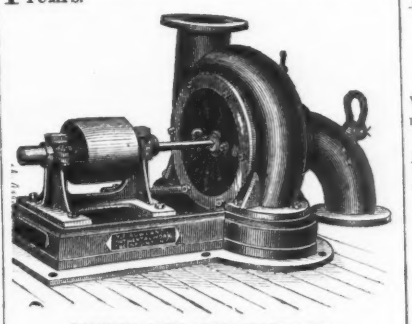

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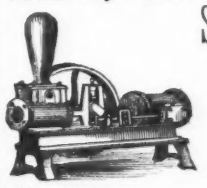

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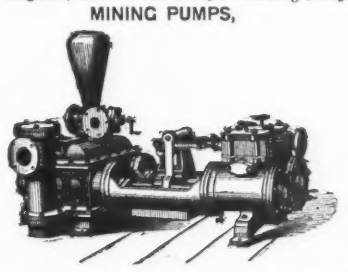

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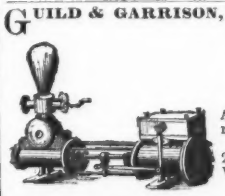

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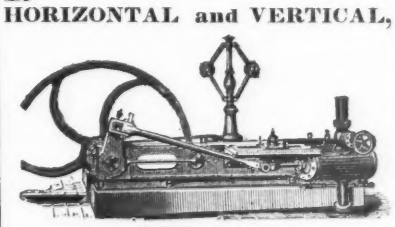

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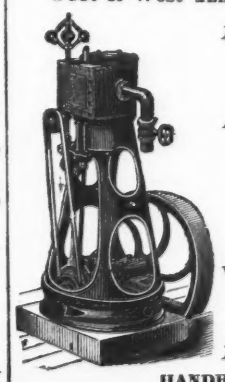

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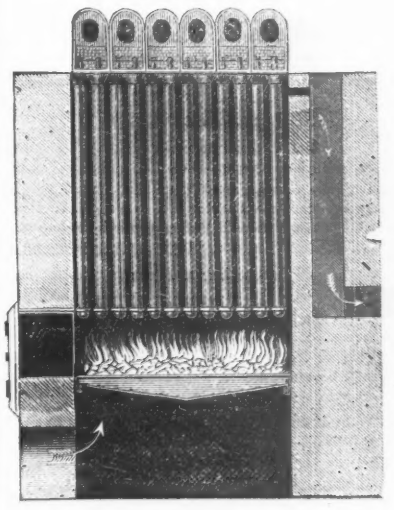

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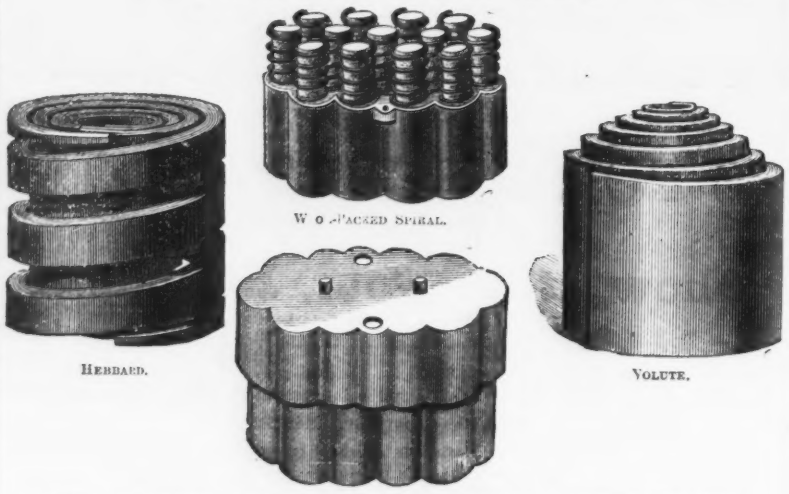

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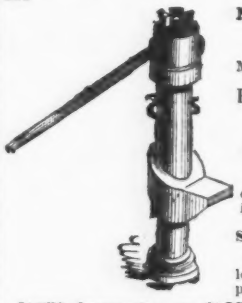

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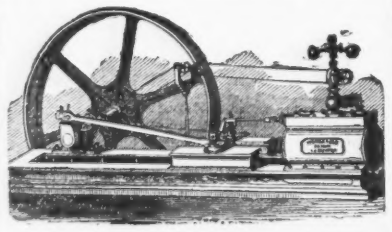

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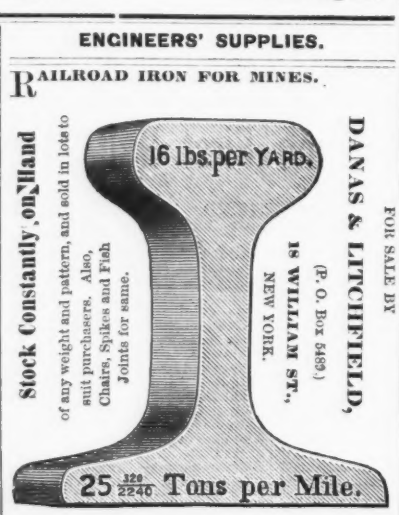

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